INSTRUCTION MANUAL

DATAPULSE INCORPORATED

3 MC PULSE GENERATOR

MODEL 102

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This manual contains general and detailed instructions for use and maintenance of your DATAPULSE Model 102 3 MC Pulse Generator. A complete understanding of its contents will contribute greatly to full utilization of the broad capabilities of this instrument.

Additional copies of this manual are available at extra cost from DATAPULSE or the DATAPULSE Field Engineer or Representative in your area.

DATA SYSTEMS • PULSE INSTRUMENTATION

DATAPULSE

SPECIAL NOTICE
Model 102 Pulse Generator Instruction Manual
December 3, 1962

DATAPULSE INCORPORATED, 509 HINDRY AVE., INGLEWOOD 1, CALIF. ORCHARD 1-7713 - OREGON 8-3883

MODEL 102 POWER SUPPLY CALIBRATION
(Reference Instruction Manual Page 19-21)

Due to tolerances in bias circuit components and tube cut-off characteristics, the optimum setting of the +100v power supply may vary ±5% from 105 volts.

With this voltage set too low the pulse width circuits will fail at 3 mc. With this voltage set too high the delay circuits will double trigger at repetition rates around 10 kc and 5 μsec. delay.

For this instrument the optimum voltage was found to be _____ volts.

August 29, 1962

ADDENDUM
MODEL 102 INSTRUCTION MANUAL
Effective Serial No 195

Reference Schematic Drawing 40000-000

1. Delete C73 through C76, R146, L6, L10
2. Change R71 and R76 from 150Ω to 10Ω 2w
3. Add series network consisting of 25-280 pf trimmer and 100Ω ½w resistor between floating B+ and Pin 8 of V16.

Reference Page 38:

Item 15: Should read: Observe that rise and decay time are equal to less than approx. 10 ns (12 ns max.), (from 10% to 90% point on leading edge and lagging edge respectively).

MODEL 102 INSTRUCTION MANUAL

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I SPECIFICATIONS

General Description: Model 102 Pulse Generator is designed for wide versatility in repetition rate, delay, pulse width, amplitude and pulse shape control. Vernier control of pulse is realized through the use of a 1, 2, 5 range switching arrangement. The vernier control fills in from say 1 to 2, or 2 to 5, or 5 to 10 in a decade switching pattern to give high resolution, but convenient switching.

This instrument is ideal for the advanced laboratory, production line or testing operations.

Regulated power supplies insure low jitter and amplitude stability. Electronic overload protection for the output pulse automatically limits the output pulse amplitude.

Repetition Rate:

Internal - 2 cps to 2 mc in 19 calibrated steps following a 1, 2, 5 pattern. In addition an uncalibrated vernier control permits pulse repetition rate to be continuously variable from 2 cps to 3 mc.

External- Requires 20V RMS sinewave from 200 cps to 500 KC or positive pulse 20 volts with rise time less than 2 μs from 0 cps to 3 mc.

Single pulse - A momentary contact push button switch provides one cycle of output for each push of the button when repetition rate switch is in external position.

Sync. output - Positive 20 volt pulse from less than 100Ω AC coupled approximately 0.1μs wide.

Pulse Delay:

0.5 microseconds to 10 milliseconds in 14 calibrated steps following a 1, 2, 5 pattern. In addition an uncalibrated vernier control provides delay continuously variable from approximately .20μs to 10 milliseconds.

Pulse Width:

0.5 microseconds to 10 milliseconds in 14 calibrated steps following a 1, 2, 5 pattern. In addition an uncalibrated vernier control permits pulse width continuously variable from approximately 0.05 microseconds to 10 milliseconds.

Main Pulse Output:

Polarity - Selectable either positive or negative with base line around ground. In addition a no output position is provided.

Rise Time - Rise time is continuously variable from approximately 10 nanoseconds to approximately 0.5 microseconds.

Decay Time - Approximately 10 nanoseconds with a 50 ohm load. Decay time is affected slightly by the setting of the rise time control.

Amplitude - Greater than 50 volts delivered into 50 ohms load.

Attenuation at 50Ω Impedance Level - 0 to 60 db in 2 db calibrated steps. In addition an uncalibrated vernier control permits attenuation to be continuously variable from 0 to 50 db.

I SPECIFICATIONS

Over Shoot - Variable to less than 4%.

Top Slope - Variable to less than 3% on pulses of 1 millisecond or less.

Output Duty Cycle and Overload Protection - Due to the use of a regulated power supply to insure stable operation under conditions of fluxuating line voltage, output current is limited to an average of 225 ma. An overload protection circuit is provided in the event that this condition is exceeded. This circuit holds output current at a safe value by reducing output amplitude. An indication light glows when this circuit is in operation. Upon removal of overload condition the circuit automatically reverts to normal operation.

Power Supplies:

Electronically regulated for stable operation under conditions of widely varying load and fluctuating line voltage.

Line voltage requirements 105 to 125 VAC or 210 to 250 VAC.

Power Required - Approximately 500W.

Line Frequency - 50/60 cycles.

Ventilation:

Forced Filtered Air.

Construction:

Aluminum-Alloy chassis and 2 piece cabinet.

Epoxy glass printed wiring chassis.

Photoetched satinized front panel.

Beige epoxy (FD#25189) finished cabinet.

Height 8 3/4".

Width 17".

Depth 15 1/4".

Weight 55 pounds.

Instrument may be rack mounted with a simple adaptor.

II OPERATING INSTRUCTIONS

CONTROLS & CONNECTORS

Power On Switch: Connects or disconnects AC input voltage to transformer primaries within instrument.

Pilot Lamp: Lights when power is on.

Repetition Rate: A 20 position switch which sets the values of R and C in the oscillator to determine pulse repetition frequency. 1 position is provided for external triggering.

Repetition Rate Vernier: A Potentiometer concentric with Repetition Rate switch provides an uncalibrated fill in control between positions of Repetition Rate switch.

Single Pulse Button: A momentary contact push-button switch which initiates one cycle of output for each push of the button when Repetition Rate switch is in EXT. position.

Positive External Trigger Input: BNC connector accepts 20 v RMS sinewave or 20v Pos pulse, 1μs rise 100 CPS to 3 MC to externally drive the oscillator when Repetition Rate switch is in the EXT. position.

Positive Sync Output: BNC connector couples a 20v positive sync pulse which provides a "0" time reference for the Delay circuit.

Pulse Delay: A 14 position switch which sets the values of R & C in the delay circuit to determine pulse delay.

Pulse Delay Vernier: A potentiometer concentric with pulse delay switch which provides an uncalibrated fill-in between positions of the pulse delay switch.

Pulse Width: A 14 position switch which sets the values of R & C in the width circuits to determine pulse width.

Pulse Width Vernier: A potentiometer concentric with pulse width switch which provides an uncalibrated fill-in between steps of the pulse width switch.

Polarity: A 3 position switch which selects positive, negative or zero output.

Rise Time: A potentiometer, mounted concentric with the polarity switch, which varies the rise time of the output pulse.

Attenuation 0-10 db attenuator: A 6 position switch which selects 0 to 10 db of attenuation in steps of 2 db.

REPETITION RATE
VERNIER
PULSE DELAY
VERNIER
PULSE WIDTH
POLARITY
ATTENUATION
DATAPULSE
102 PULSE GENERATOR
SINGLE PULSE
POSITIVE SYNC OUTPUT
PILOT
POWER ON
PULSE OUTPUT

II OPERATING INSTRUCTIONS

CONTROLS & CONNECTORS (Continued)

Attenuator Vernier: A potentiometer mounted concentric with 0-10 db attenuator which provides an uncalibrated fill-in between steps of the 0-10 db attenuator.

0-50db: A 6 position switch which selects 0-50 db of attenuation in steps of 10 db.

Pulse Output Connector: UHF connector couples variable parameter pulse to external load.

Average Pulse Current Overload: Red indicator light which when lit indicates maximum average current limitation has been exceeded and overload protection circuit is in operation.

Fuse (Located on rear panel): A 5 amp fast blow fuse protects instrument against AC overload.

Power Input (Located on Rear Panel): 3 prong male connector connects instrument to AC line through NEMA 3 wire line cord.

PLACING IN OPERATION

(a) Set Pulse Repetition Rate Switch to 1 KC; Vernier ccw.
Set Pulse Delay Switch to 0.5us; Vernier cw.
Set Pulse Width Switch to 0.5 us; Vernier cw.
Set Polarity Switch to +; rise time ccw.
Terminate output pulse into 50 ohm.

(b) Set power switch to ON.
Note that pilot lights.

(c) Sync Scope from positive sync output.
Sweep speed 0.5us/cm.
Vertical sensitivity 20v/cm.

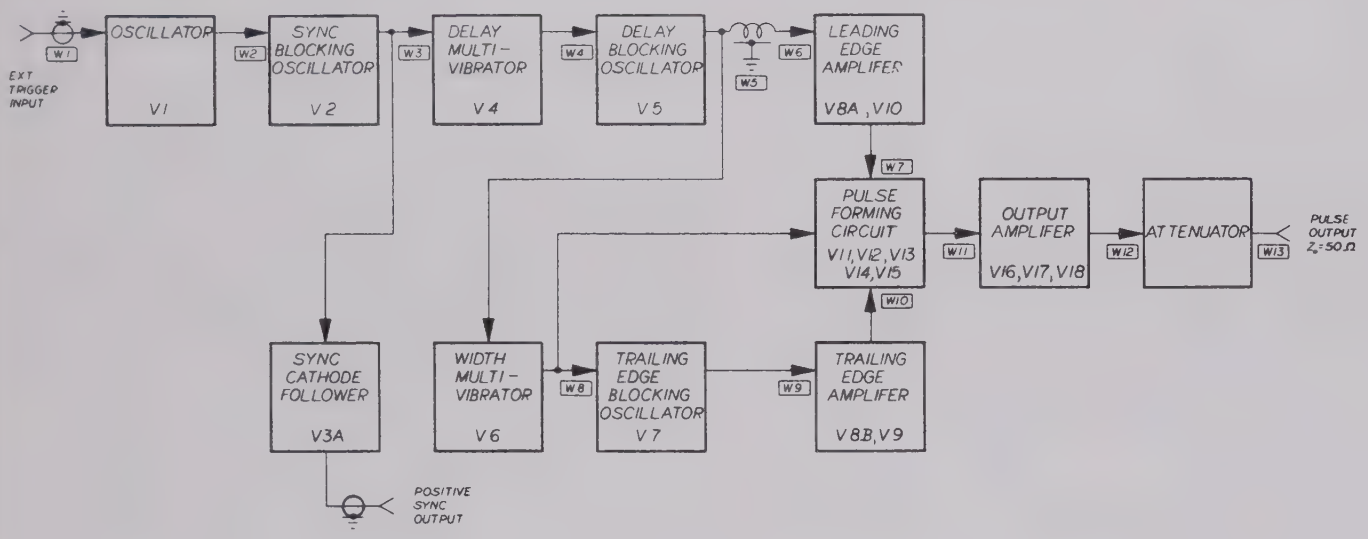
(d) View output pulse and verify presence of same.

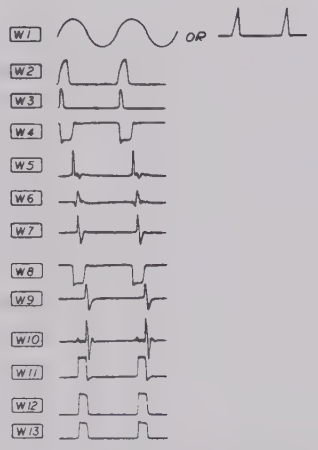
(e) Allow instrument to warm up 1/2 hour before operating.

III THEORY OF OPERATION

BLOCK DIAGRAM DESCRIPTION (Refer to Drawing No. 41000-000)

A pulse repetition rate (W2) variable between 2 cps and 3 mc is determined by either the internal oscillator or an external drive. The output of the Oscillator (W1) is used to trigger the Sync Blocking Oscillator which provides a "Zero" time reference pulse (W3). This pulse is coupled-out (in the Sync Cathode Follower) as a sync pulse and is used to trigger the Delay Multivibrator. The gate from this MV is differentiated and the trailing edge portion is used to trigger the Delay Blocking Oscillator. The output from the Delay BO (W5) is used to trigger the Width MV and is also delayed (0.09 us) to become the leading edge trigger (W6) which is amplified by the Leading Edge Amplifier. The width gate (W8) is differentiated and used to trigger the Trailing Edge BO, which is amplified by the Trailing Edge Amplifier. Using the leading and trailing edge triggers (W7) and (W10) in conjunction with the duration gate (W8), a fast rise and fall pulse is formed. This pulse (W11) is cathode-follower coupled to the output amplifiers where it is transformed into a heavy current pulse (W12) which is applied to the attenuator and attenuated to the level desired to give the output pulse (W13).





REVISIONS

41000-000

LIST OF MATERIALS

TITLE	BLOCK DIAGPAM – 3MC PULSE GENERATOR
	MODEL-102
SCALE	NONE
DWG NO	D 41000-000
SHEET	1 OF 1

DATAPULSE INC. CULVER CITY, CALIF.

41000-000 M-102

APPLICATION

DO NOT SCALE DWG.

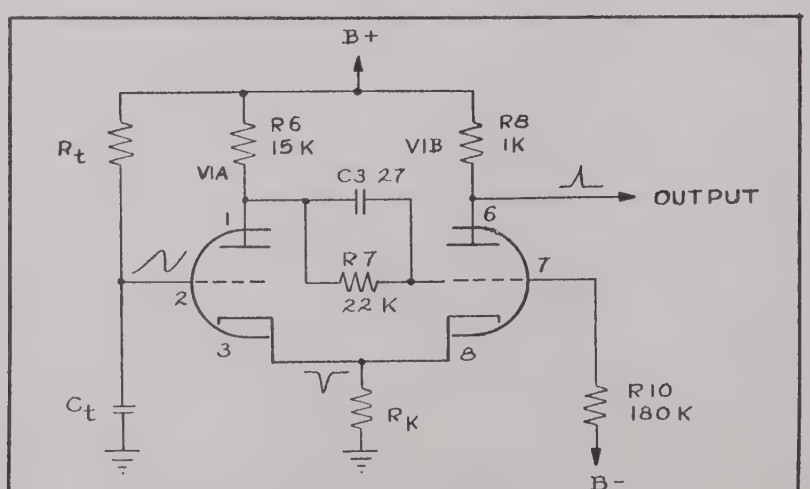
III THEORY OF OPERATION

Astable Schmidt Trigger

The Astable Schmidt trigger circuit differs from a normal Schmidt trigger in that the changing network CT and RT (see diagram) produces a controlled positive going waveform on the grid (pin 2) of the trigger tube. This circuit functions as follows: V1B conducts heavily because of the bias imposed upon it by R6, R7, and R10 between B+ and B-. The current of V1B flows through RK causing a large voltage drop which appears as a positive potential at the common cathode pins 3 and 8. As the grid (pin 2) of V1A is around ground V1A is cut off by the positive potential at its cathode (pin 3). At a time (t), Ct begins to charge through Rt toward B+. This charge continues until time (t2) when the grid-to-cathode-voltage of V1A is small enough to allow conduction. As V1A conducts, its plate (pin 1) dips sharply because of current flowing through R6 (15K). This negative going potential is coupled across R7 (22K) and C3 (27uuf) to the grid of V1B (pin 7). The conduction of V1B now decreases, decreasing the cathode potential of V1A causing V1A to conduct harder and thus regeneratively saturate itself and cut off V1B.

Because R6 is 15K and R8 only 1K, much less current flows through RK as V1B cuts off and its cathode potential approaches ground. The grid of V1A (pin 2) follows the cathode down, discharging Ct through grid current. At a time (t3), a point around ground is reached where the cathode to grid potential is low enough for V1B to conduct. An attendant increase of current through RK causes a higher potential at the cathode of V1A (pin 3). As V1A decreases conduction and its plate (pin 1) becomes more positive, this waveform coupled across R7 and C3 to the grid of V1B (pin 7) causes V1B to conduct harder with an attendant increase of current through RK which regeneratively saturates V1B and cuts off V1A. Ct now begins to charge through Rt toward B+ and the cycle is repeated.

The output of this circuit is taken from the plate of V1B (pin 6) and is used to trigger the Sync Blocking Oscillator (V2).



ASTABLE SCHMIDT TRIGGER CIRCUIT

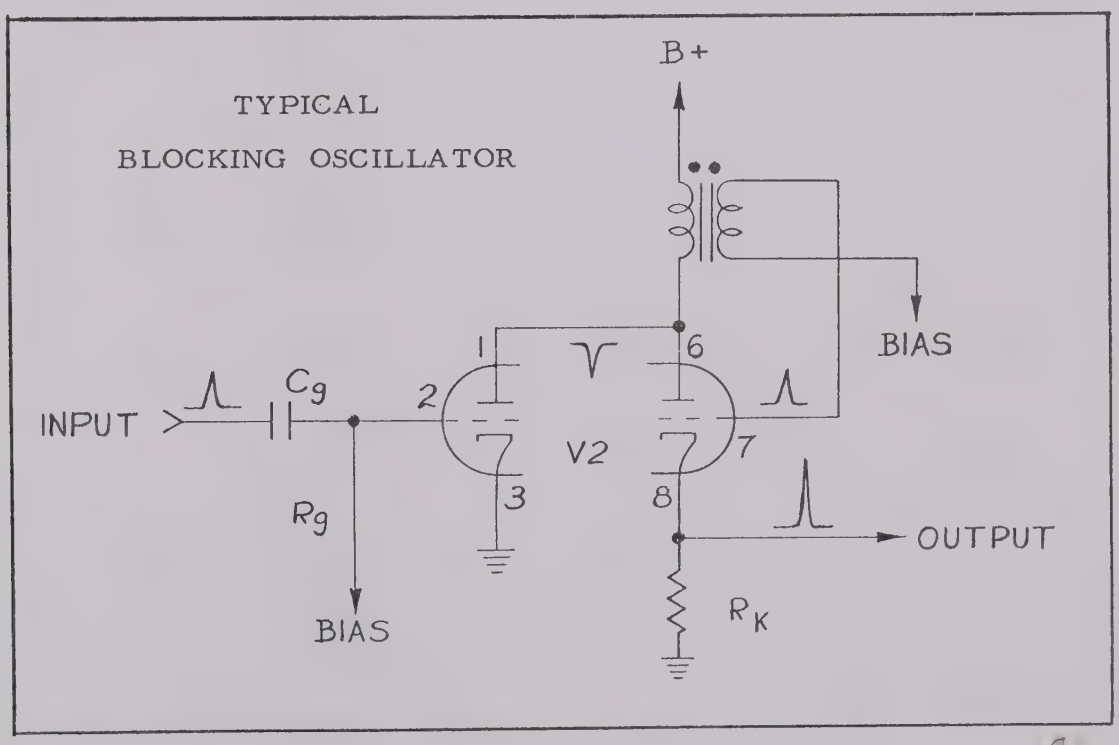
III THEORY OF OPERATION

Blocking Oscillator

The sync blocking oscillator is typical of the delay BO and trailing edge BO (see sketch) and operates as follows:

Initially both sides of the tube are cut off because of grid bias returns.

When a positive pulse arrives at the grid (pin 2) of the left hand section, conduction is initiated driving both plates negative. Due to the polarity of the transformer a negative pulse upon the plates appears as a positive pulse upon the grid (pin 7) of the right hand side of the tube causing this tube to conduct. This added current drives the plate more negative which in turn reinforces the signal at the grid etc. until the plate (pin 6) of the right hand section is driven into saturation. At this point the gain from grid to plate becomes less than one and the process reverses itself driving the tube into cut off which completes the cycle. The output of this circuit is taken off the cathode (pin 8) of the right hand side across RK.



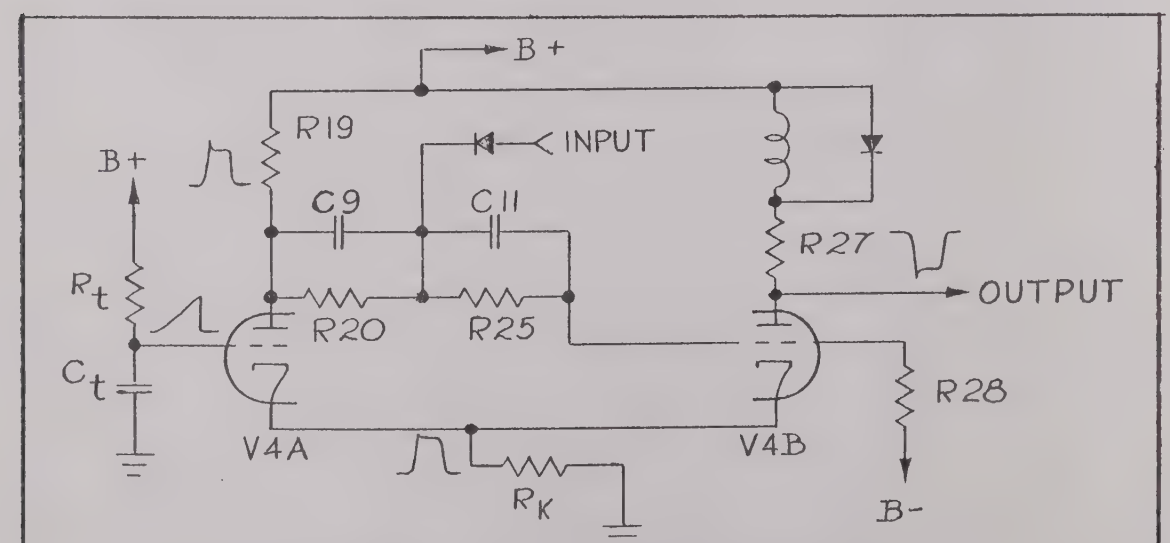
III THEORY OF OPERATION

One Shot Multivibrator

Pulse delay circuitry is a cathode coupled one shot multivibrator. Since pulse width generation is essentially a delay function, (i.e., the delay of trailing edge with respect to leading edge) the same technique is used to perform both operations. For this reason only delay shall be discussed.

In the quiescent state, V4B is cut off because of the bias imposed upon its grid (pin 7) by the voltage divider composed of R19, R20, R25 and R28. V4A is conducting because of its positive grid return through Rt. As the plate load R19 is great (100K with respect to RK), the common cathodes of V4A and V4B are at a potential around ground. At time (t0) a positive input trigger causes V4B to conduct and because of the low impedance (470) in the plate of V4B (pin 6) a large current flows through RK causing the cathode of V4A (pin 3) to become sufficiently positive to cut off V4A. As the plate (pin 1) of V4A becomes more positive, because of decreased current flow, this waveform is coupled across C9- R20 and C11-R25 to the grid of V4B causing more current to flow, regeneratively saturating V4B. As soon as the cathode of V4A (pin 3) becomes more positive than its grid (pin 2) Ct begins to charge through R5. This charge continues until a point is reached at time (t2) when the grid of V4A (pin 2) is sufficiently positive to allowV2B to again conduct driving its plate (pin 1) negative. This negative waveform coupled across C9-R20 and C11-R25 to the grid of V4B (pin 7) causes conduction of V4B to decrease, forcing the cathode of V4A less positive and increasing conduction, regeneratively saturating 4VA and cutting off V4B. The cathodes of V4A and V4B return to their quiescent state and the grid of V4A follows the cathodes down as grid current discharges Ct completing the cycle.

The triling edge of the negative gate at the plate of V4B (pin 6) is differentiated and used to trigger the delay blocking oscillator. In the case of pulse width, this gate becomes the duration gate.

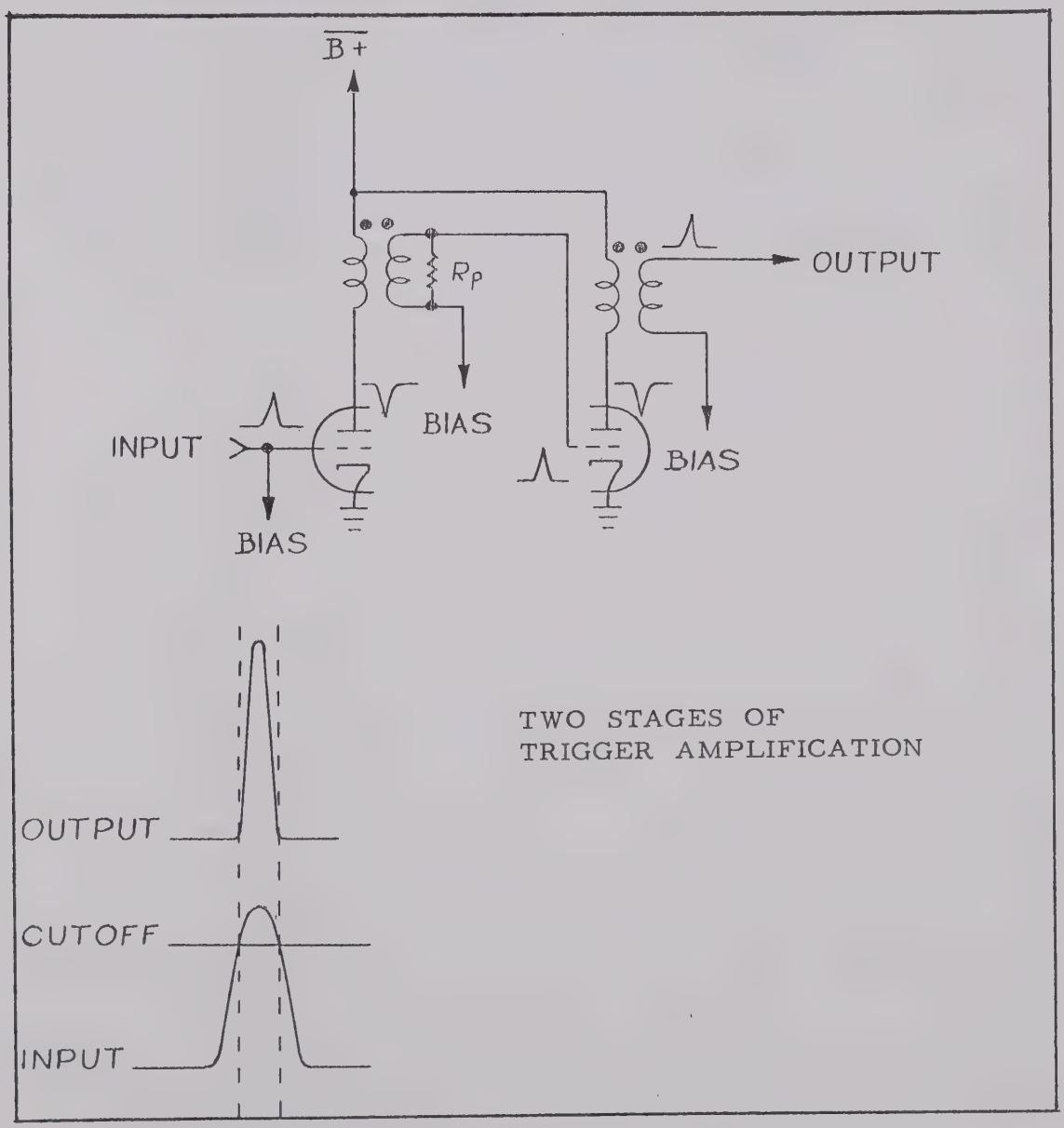


CATHODE COUPLED MULTIVIBRATOR

III THEORY OF OPERATION

Transformer Coupled Amplifier

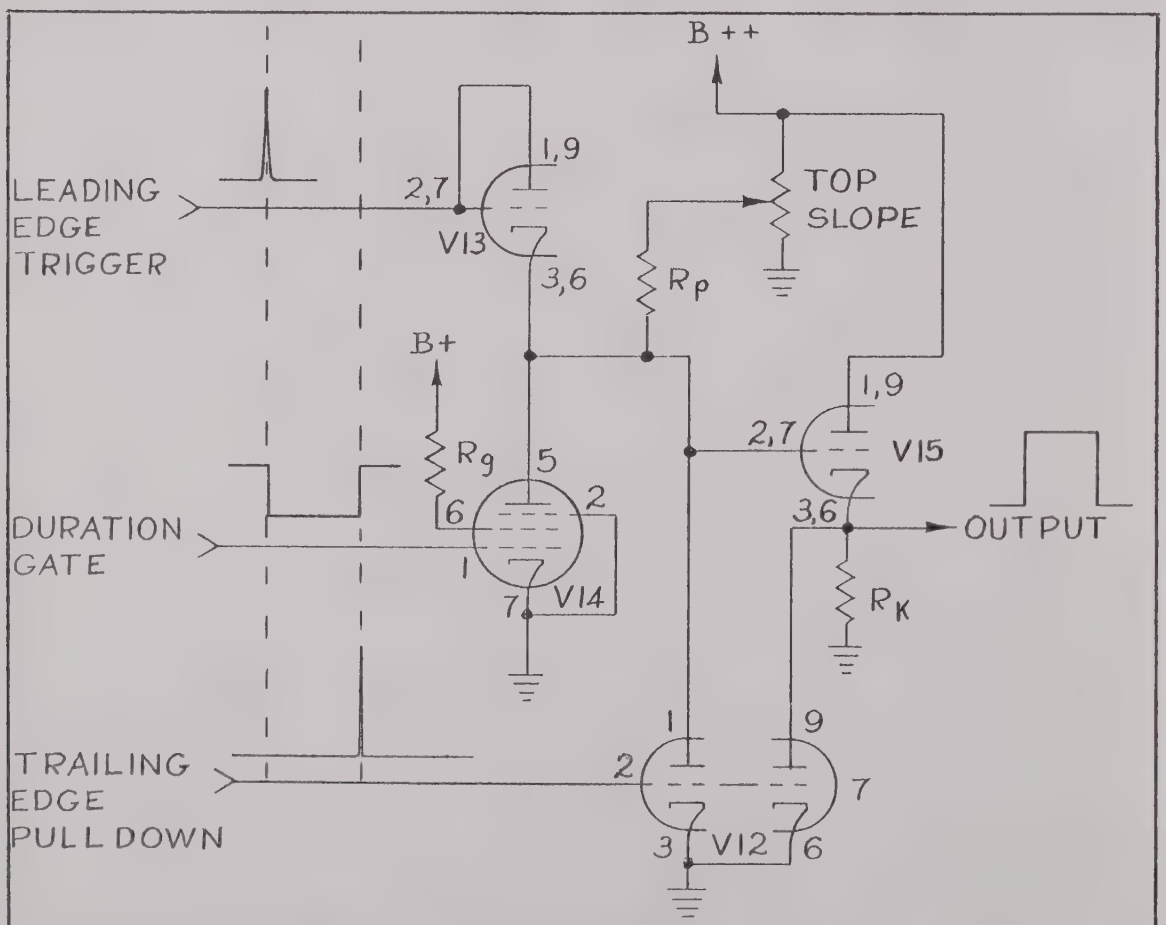
Initially the tube is cutoff because of bias return. As a positive pulse is applied to the grid, the plate conducts heavily and goes negative. The polarity of the transformer is such that a negative charg e upon the plate provides a positive going signal to the grid of the next tube. Rp is used to damp the secondary of the transformer to prevent oscillations. Pulse narrowing takes place (see sketch) as each preceding tube only conducts as the pulse is above the cutoff point thus elimi n a ting the time from base line to approximately 85% amplitude point.



III THEORY OF OPERATION

Pulse Forming Circuits

V14 is normally conducting because of its positive grid return. Its plate (pin 5) sets slightly above ground. The negative duration gate applied at its gird (pin 1) cuts off V14 and its plate starts to rise at a rate governed by circuit capacity. A few nanoseconds later the leading edge trigger is applied to the "lift up diode" (V13) whose low impedance charges the capacitor rapidly causing a fast rise leading edge. The top of the pulse remains at the voltage set by the top slope control as V14 is still held off by the duration gate for the duration of the pulse. The fast rise pulse is applied to the grid (pin 2 and 7) of the cathode follower (V15), whose output drives the output amplifier section. At the end of pulse time, the gate at the grid of V14 subsides and V14 begins to conduct. Simultaneously the positive trailing edge trigger is applied to the grids (pin 2 & 7) of the trailing edge pull-down tube V12 driving its plate sharply negative discharging circuit capacity and creating a fast fall trailing edge. This fast rise and fall positive pulse is then applied to the output amplifier section. The capacitors C34 (overshoot) and C39 will provide a fee back network to trim pulse irregularities.



SIMPLIFIED PULSE FORMING CIRCUITS

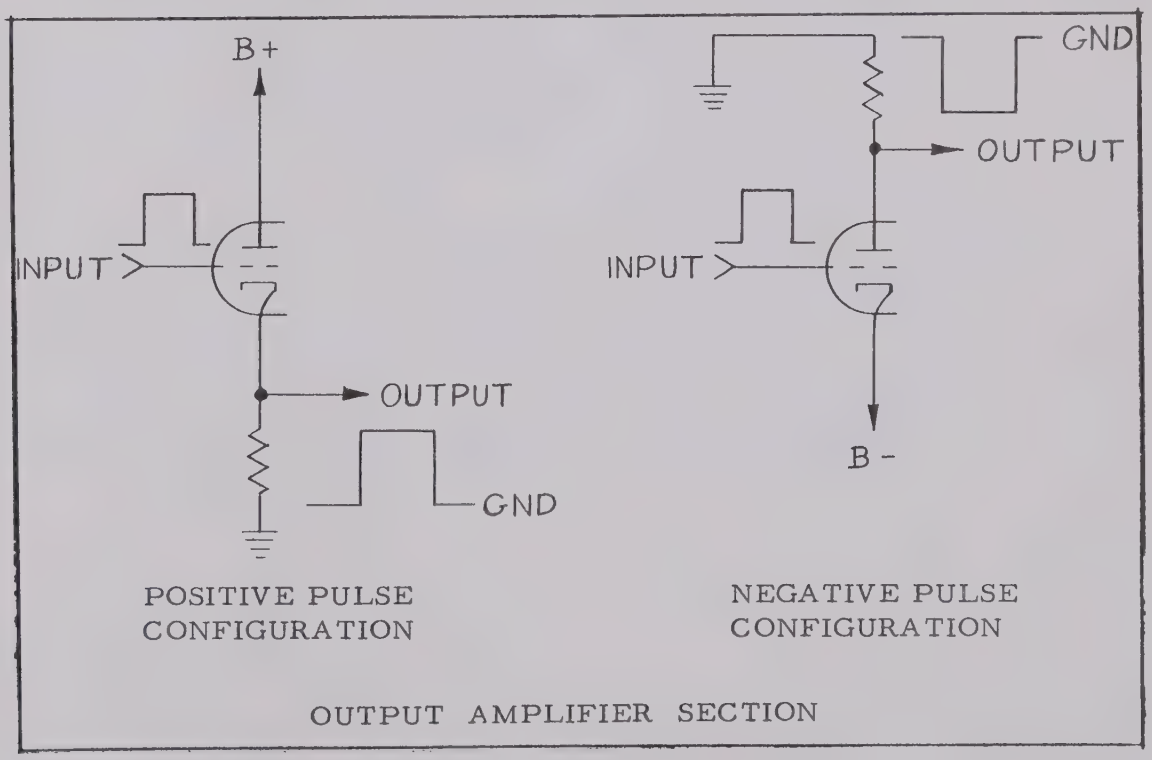
III THEORY OF OPERATION

Output Amplifier

The fast rise and fall pulse from V15 is coupled across C40 to the rise time control R64. Since no commutation is provided, an increase in the resistance of R64 will cause rise time to be increased in an exponential manner because of the input capacity of the output tubes V17 and V18. The output tubes are connected such that, through boot strappings, the screen to cathode voltage and hence screen to control grid voltage remains relatively constant with resultant increase in gm yielding a greater degree of wave shape preservation from input to output.

Positive output pulses are obtained from cathode followers with base line around ground potential. As polarity is changed to negative, the output tube configuration is changed to operate the output tubes as amplifiers, with output taken at the plate. In addition, the ground reference for the power supply is switched such that the base line remains around ground.

Bias is provided through a cathode follower whose low impedance discharges C40 effectively to prevent a bias shift with changes in duty cycle.



OUTPUT AMPLIFIER SECTION

III THEORY OF OPERATION

Overload Protection Circuit

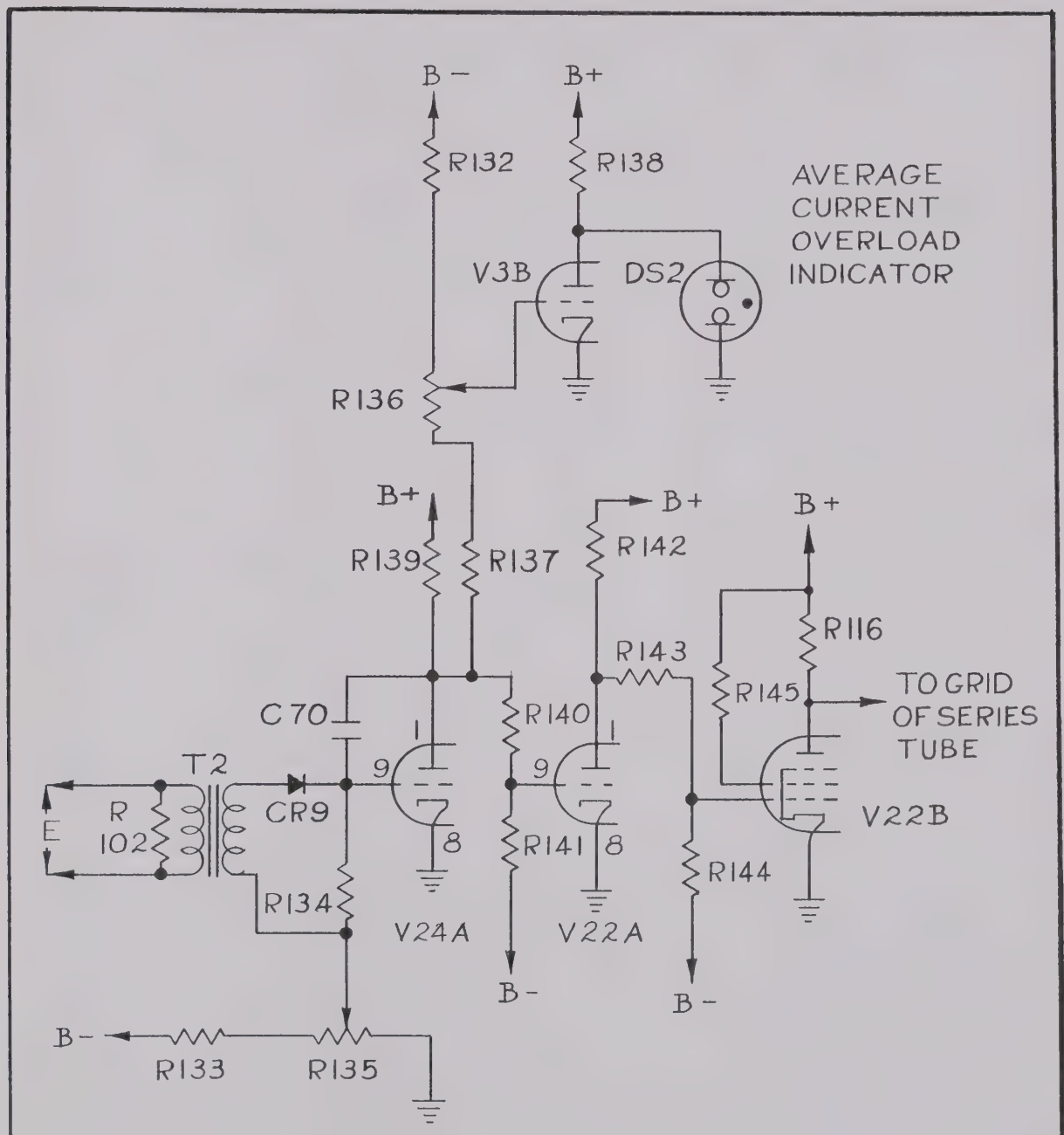
An overload protection circuit is employed to insure that output current does not exceed a safe value. In the event that this limitation is inadvertently exceeded by control settings, a red warning light glows to to indicate that this circuit is in operation.

Output current is sampled through R102 and T2 located in the center tap of the output voltage transformer winding. This sample is rectified by CR9 and filtered by the integrating action of V24A and appears as a dc voltage upon the control grid of V24A as current rises to a point predetermined by the setting of R135. V24A will conduct heavily enough to drop the voltage at its plate (pin 1) appreciably. This negative potential is coupled through R140 to the grid (pin 9) of V22A causing V22A to cutoff. The plate (pin 1) of V22A then rises causing a rise at the control grid (pin 2) of V22B. V22B now conducts heavily pulling down the grid of the +225 supply limiting the output of the $^{+}$225 supply to approximately 150v. This lowered supply to the pulse forming circuit causes sufficient reduction of the amplitude of the output pulse to hold output current at a safe value. The plate of V24A is also coupled to the grid of V3B. As the plate of V24A drops, the grid of V3B drops cutting off V3B. Connected in parallel with V3B is an Ne2 (overloading indicator) which lights as the plate of V3B goes sufficiently positive.

By setting R136, the indicator is caused to light slightly before the +225 volt supply is reduced.

Note, that as the gain of the servo loop is greater than one, the output voltage may "cycle" somewhat as the circuit is in operation. Because of this the instrument should not be operated in overload condition as erroneous readings will result.

As duty cycle is reduced and output current decreases, the circuit settles back to quiescent state and normal operation ensues.



OVERLOAD PROTECTION CIRCUIT

IV MAINTENANCE INSTRUCTIONS

Maintenance Notes

Visual Inspection:

You should inspect the generator periodically for circuit damage. This may take the form of improperly sealed tubes, broken or scorched wires, loose or broken terminals or connections, scorched resistors, corrosion, etc.

The main printed wiring board may become discolored due to heat in certain areas, particularly in rack mounted situation where adequate attention is sometimes not given to providing cooling air to the rack, this does not affect the electrical properties of the board and in most cases may be disregarded. However, if this condition is noted, more frequent and thorough cleaning of the air filter may be the cure.

Air Filter:

This instrument is cooled by air drawn into the interior through a washable filter constructed of aluminum mesh which is adhesive coated. If the filter becomes dirty, it will restrict the flow of cooling air and the instrument will over-heat.

To clean filter, rap gently on a hard surface to remove loose dirt. Wash filter in hot soapy water. DO NOT USE CAUSTICS TO CLEANSE FILTER. After rinsing and thorough drying, dip or spray filter with Handi-koater or Filter-Coat, products of the Research Products Corp., or with any other approved adhesive.

Fan Motor:

The fan motor should be lubricated periodically with a few drops of light machine oil.

Recalibration:

As maximum attention was given during design of this instrument to insure maximum reliability and stability. It should provide trouble free operation for extreme periods of time. However, to insure that the accuracy remains within the stated limits, we suggest that calibration be checked after every 200 hours of operation. If the equipment is used intermittently calibration should be checked every 3 months.

Tubes:

Tube failure is the most prevalent form of circuit failure. The best method of tube checking is by substitution of known good tubes. Do not depend upon tube testers to indicate the usefulness of a tube in a particular circuit. The true test of suitability is whether the tube works in the circuit or not. Care should be taken to insure that tubes are not replaced unless they are actually causing trouble as unnecessary replacement of tubes will often necessitate recalibration. For this same reason it is important that tubes removed for maintenance reasons be returned to the same socket from which they were removed unless found to be defective.

IV MAINTENANCE INSTRUCTIONS

Calibration & Adjustment Model 102

At the outset of calibration, one should verify that the equipment is operating correctly and that the instrument has been warmed for at least 1/2 hour.

While the instrument is warming up, assemble the following:

1. A general purpose 30 MC oscilloscope such as Tektronix 543 or equivalent including type "L" high gain preamplifier and Type "N" sampling plug-in or equivalent.

2. A DC Voltmeter such as Simpson 260 or equivalent (If overload circuit is to be calibrated, two will be required.)

3. An insulated low capacity screwdriver.

4. A variable AC source such as Powerstat Model 116 or equivalent.

5. A 50 ohm external termination such as DATAPULSE Model 1002 or equivalent.

6. A 500 KC signal generator such as HP #233A or equivalent.

7. If overload circuit is to be calibrated, a tube socket adapter such as Vector T80C will be required.

IV MAINTENANCE INSTRUCTIONS

Power Supply Calibration

NOTE:

As the timing circuits are dependent upon the regulated power supply voltages for reference, any variance of these voltages will necessarily cause a change in calibration accuracy. Therefore, these adjustments should not be attempted unless one is prepared to carry out complete re-calibration.

If power supply voltages are found to vary considerably from specified voltage temporary readjustment may be made; however, one must bear in mind that measurements made may not be accurate until the instrument has been recalibrated. If any portion of the instrument fails to calibrate, repair should be effected before attempting to complete calibration.

-105V (B-) Supply: This voltage is determined within approximately ± 10% of -105V and regulated by a gas tube (OB2) and no adjustment is provided. This voltage is used as a reference for the +100V and the +225V power supplies and should, therefore, be checked prior to adjustment of these supplies.

1. Connect a DC Voltmeter from tp8 (-105V) to ground. Vary line voltage with variac ± 10% from 115 VAC and verify regulation.

Power Supply Calibration (Continued)

+110V (B+) Supply:

1. Connect DC Voltmeter from tp9 (+110V) to ground. Adjust R130 (+100V adjust) for a reading of 110V.*

2. Vary line voltage $\mp$ 10% around 115V and observe that power supply variation is less than $\pm$ 2V.

3. Remove voltmeter and connect a high gain oscilloscope from tp9 to ground. Observe that ripple is $<$ 50MV with pulse repetition rate switch in EXT. position.

+225V Supply:

1. Connect DC Voltmeter from TP10(+225V) to ground. Adjust R127 (+225V adjust) for a reading of 225V.

2. Vary line voltage $\mp$ 10% around 115V and observe that power supply variation is less than $\pm$ 5V.

3. Remove voltmeter and connect a high gain oscilloscope from TP10 to ground. Observe that ripple is $\lesssim$50 MV with pulse repetition rate switch in EXT. position.

+150V (Floating) Supply:

1. Place pulse repetition rate switch in EXT. position.
Place Polarity switch in + position.

2. Connect DC Voltmeter from TP11 to ground and adjust R100 (+150V adjust) for a reading of 150V.

3. Vary line voltage $\mp$ 10% around 115V and observe that power supply variation is less than $\pm$ 5V.

4. Remove voltmeter and connect a high gain oscilloscope from TP11 to ground. Observe that ripple is $\lesssim$ 50MV.

BIAS:

1. Place DC Voltmeter from junction of CR 22 & C 54 to ground. See that reading is -18V +30%-0%.

Power Supply Calibration (Continued)

BIAS:

2. Place DC Voltmeter from junction of R110 and R111 to ground. See that reading is between 5.1-6.2V. Vary line voltage ± 10% around 115V. See that reading does not vary more than 1%.

IV MAINTENANCE INSTRUCTIONS

Repetition Rate Calibration

1. Set repetition rate control to 1 KC, Vernier fully CCW.
   Set pulse delay control to 0.5μs, Vernier fully CCW.
   Set pulse width control to 0.5μs, Vernier fully CW.
   Set polarity to +, attenuator controls fully CW, rise time fully CCW, terminate pulse output into 50 ohm load (DP #1002)

2. View pulse output on a calibrated sweep oscilloscope. Set R214 (1KC adjust) for 1 millisecond pulse spacing (1KC)

3. Check oscillator ranges from 0. CPS to 10KC and insure that calibration is within ± 10%. (It may be necessary to readjust R214 so that all ranges from 2 CPS to 10 KC are within ± 10%.)

4. Set pulse repetition rate switch to 50 KC. Adjust C206 (50 KC adjust) for a pulse spacing of 20μs. (50 KC) Check 20 KC and 0.1 MC ranges and insure that these are within ± 10%.

5. Set pulse width Vernier fully CCW, set pulse repetition rate switch to 2 MC, Vernier fully CW. Adjust C203 (3MC Adjust) for a pulse spacing of 0.33μs (3MC).

6. Set Vernier fully CCW. Adjust R201 (2MC Adjust) for a pulse spacing of 0.5μs (2MC)

7. Set pulse repetition rate switch to 1MC. Adjust R211 (OSC Adj) for a pulse spacing of 1μs (1MC). Check 0.5MC and 0.2MC ranges and insure that calibration is within ± 10%.

8. Set pulse repetition rate switch to EXT. Apply to EXT. trigger input jack and 20V RMS 500 KC sine wave and insure that instrument is triggering reliably.

9. Remove sine wave source and depress single pulse push button (pulse width set to 10MS, Vernier fully CW) observe one cycle of operation.

Pulse Delay Calibration

1. Pulse spacing $\left[\frac{1}{\text{Repetition Rate}}\right]$ should be kept at least 10 times pulse delay at all times.

2. Set pulse repetition rate switch to 200 CPS. Vernier fully CCW. Set pulse delay switch to 0.5MS; Vernier fully CW. Set pulse width to 0.5μs; Vernier fully CW. Set polarity to T, attenuator controls fully CW.
   View output pulse terminated into 50 ohm.

3. Set R301 (delay adj) for pulse delay of 0.5MS.

4. Check ranges from 20μs to 10 MS and insure that they are within ± 10%. (It may be necessary to change the setting of R301 somewhat.)

5. Set pulse delay switch to 5μs.

6. Set C302 for 5μs pulse delay.

7. Check 10μs & 2μs ranges and insure that they are within ± 10%.

8. Set pulse delay switch to 0.5μs.

9. Set C306 for 0.5μs pulse delay.

10. Check 1μs range and insure that it is within ± 10%.

IV MAINTENANCE INSTRUCTIONS

Pulse Width Calibration

1. Pulse spacings $\left[\frac{1}{\text{Repetition Rate}}\right]$ should be kept at least 10 times pulse width.

2. Set pulse repetition rate switch to 200 CPS, Vernier CCW.
   Set pulse delay switch to 0.5μs, Vernier fully CW.
   Set pulse width switch to 0.5MS, Vernier fully CW.
   Set polarity to +, attenuator controls fully CW.
   View output pulse terminated into 50 ohm.

3. Set R401 (width adj) for a pulse width of 0.5MS.

4. Check ranges from 20μs to 10MS and insure that they are within ± 10%. (It may be necessary to change the setting of R401 slightly)

5. Set pulse width switch to 5μs.

6. Set C402 for a pulse width of 5μs.

7. Check 10μs & 2μs ranges and insure that they are within ± 10%.

8. Set pulse width switch to 0.5μs.

9. Set C406 for a pulse width of 0.5μs.

10. Check 1μs range and insure that it is within ± 10%.

IV MAINTENANCE INSTRUCTIONS

Output Waveform

Because the rise of the output waveform is faster than the rated response of most general purpose (30MC) oscilloscopes, exact observation and rise time measurements may not be made without resorting to either a sampling oscilloscope or traveling wave oscilloscope. Viewing directly on the deflection plates of a slower scope may be used, but it must be kept in mind that there is generally considerable inductance in the deflection plate adapter and the slower sweep speed on the order of 20NS/CM makes resolution difficult. A general purpose oscilloscope is, however, sufficient for "Rough" trimming of output waveform and making top slope adjustment for wide pulses.

1. Set repetition rate control to EXT., Vernier fully CCW, set pulse delay to 0.5μs, Vernier fully CW, set pulse width to 1MS, Vernier fully CW. Set polarity to +, attenuators for 0db. Terminate output pulse into 50 ohm load. Observe output on a 0.5V/CM vertical scale.

2. Set R.90 (Pos Bias) for a base line $\leq$ 0.5V above ground.

3. Set polarity control to -, adjust R88 (Neg Bias) for a base line $\leq$ 50 MV below ground.

4. Set polarity control to +. Set repetition rate control to 0.1 KC. Rise time control fully CCW. Adjust R60 (top slope) for min. top slope. Adjust C39 (roll) for min. top slope following leading edge approximately 5μs.

5. Set pulse width to 1μs, set repetition rate to 10 KC. Adjust C34 (overshoot) for squarest leading edge with minimum overshoot.

6. Repeat steps 4 & 5 until further adjustment is unnecessary.

7. Fine adjustment of C34 (overshoot) and R88, R90 (output bias) may be made on fast response oscilloscope. Rise time control may be turned slightly CW to help trim any ringing on leading edge. At this point check that both rise and decay times are $\leq$ 10NS.

8. Because of the wide variation of all controls some combinations of settings may be found that will cause slight oscillations on the flat top. Slight alteration of any control will usually eliminate this condition.

IV MAINTENANCE INSTRUCTIONS

Duty Cycle Overload

WARNING: THIS ADJUSTMENT IS MADE AND SEALED AT THE FACTORY. ANY ALTERATION OF THIS ADJUSTMENT WILL RESULT IN THE LOSS OF WARRANTY AND MAY RESULT IN SERIOUS DAMAGE TO THE INSTRUMENT.

1. Remove V27. With an adapter such as Vector T-8-0-C, reinsert V27 with an ammeter in the plate circuit. (Note: The two halves of V27 are paralleled. Care must be taken that both halves are connected through the ammeter). Connect a DC Voltmeter from the +225V. Test Point (TP10) to ground.

2. Set pulse repetition rate control to 10KC, Vernier mid scale. Set pulse delay to 0.5μs. Set pulse width to 20μs, Vernier fully CCW. Set polarity to +, attenuation to 0db.
   Terminate output pulse into 50 ohm.
   Energize instrument.

3. Slowly turn pulse width Vernier CW until an ammeter reading of 225ma is attained.
   Adjust R135 (overload adjust) until +225V supply just begins to drop.

4. Turn pulse width vernier fully CW and insure that ammeter reading does not exceed 240ma.

5. Turn pulse width vernier CCW until ammeter reads 220ma. Note that +225V supply has returned to +225V. Adjust R136 (overload indicator) until average pulse current overload lamp on front panel just lights.

6. Turn pulse width vernier fully CCW. Note that average pulse current overload lamp extinguishes.

7. Turn pulse width vernier slowly CW. Note that average pulse current overload lamp lights at 220ma and +225V supply drops at 225ma. Also note that 240ma is not exceeded as pulse width vernier is turned fully CW. If these conditions are not met, repeat steps 3 to 7.

IV MAINTENANCE INSTRUCTIONS

Verification of Specifications Procedure

A 1/2 hour warm-up period is required before tests are made.

ASSEMBLE THE FOLLOWING:

1. 30 mc oscilloscope such as Tektronix 543 and sampling pre-amp.
2. 2 each dc voltmeter such as Simpson 260.
3. Tube socket adapter such as Vector T80C.
4. 50 ohm termination such as DATAPULSE Model 1002.
5. 500 kc Signal generator such as HP #233A.

Power Supply (Repetition Rate Switch in EXT. Position)

1. -105V Supply:
   Verify that the voltage from TP8 to ground is -105V ± 10%.
2. +110V Supply:
   Verify that the voltage from TP9 to ground is +110V, ± 10%.
3. +225V Supply:
   Verify that the voltage from TP10 to ground is +225V ± 10%.
4. +150V (Variable reference) Supply:
   With polarity switch in + position, verify that the voltage from TP11 to ground is +150V ± 10%.
5. Bias Supply:
   Verify that the voltage from junction of C54 and R110 to ground is -18V, +30% -0%.
   Verify that the voltage from junction of R110 and R111 to ground is between -5.1 volts and -6.2 volts.

IV MAINTENANCE INSTRUCTIONS

Verification of Specifications Procedure (Repetition Rate)

1. Set pulse delay control to 0.5us, vernier fully CW

   Set pulse width control to 0.5us, vernier fully CCW

   Set polarity control to +, rise time fully CCW

   Set attenuators fully CW, terminate pulse output into 50 ohm

   Sync scope from positive sync pulse output. View pulse output

   Sweep speed 0.1us/CM vertical sensitivity 20V/CM

2. See Repetition Rate Setting Chart (2. through 24.)

Verification of Specifications Procedure (Repetition Rate)

REPETITION RATE SETTINGS

	REPETITION RATE SWITCH	REPETITION RATE VERNIER	WIDTH	SCOPE SWEEP SPEED	CORRECT SPACINGS	TOLERANCE
2.	2MC	CW	Min	0.1μs/CM	0.33μs(3MC)	+0, -10%
3.	2MC	CCW	Min	0.1μs/CM	0.5μs(2MC)	± 10%
4.	1MC	CCW	Min	0.2μs/CM	1μs(1MC)	± 10%
5.	0.5MC	CCW	Min	0.5μs/CM	2μs(0.5MC)	± 10%
6.	0.2MC	CCW	Min	1μs/CM	5μs(0.2MC)	± 10%
7.	0.1MC	CCW	Min	2μs/CM	10μs(0.1MC)	± 10%
8.	50 KC	CCW	Min	5μs/CM	20μs(50KC)	± 10%
9.	20 KC	CCW	lus	10μs/CM	50μs(20KC)	± 10%
10.	10 KC	CCW	lus	20μs/CM	100μs(10KC)	± 10%
11.	5 KC	CCW	lus	50μs/CM	200μs(5KC)	± 10%
12.	2 KC	CCW	lus	0.1MS/CM	0.5 MS(2 KC)	± 10%
13.	1 KC	CCW	10us	0.2MS/CM	1MS (1KC)	± 10%
14.	0.5 KC	CCW	10us	0.5MS/CM	2MS (0.5KC)	± 10%
15.	0.2 KC	CCW	10us	1MS/CM	5MS(0.2KC)	± 10%
16.	0.1 KC	CCW	0.1MS	2MS/CM	10MS(0.1KC)	± 10%
17.	50 CPS	CCW	0.1MS	5MS/CM	20MS(50CPS)	± 10%
18.	20 CPS	CCW	0.1MS	10MS/CM	50MS(20CPS)	± 10 %
19.	10 CPS	CCW	1 MS	20MS/CM	100MS(10CPS)	± 10%
20.	10 CPS	CW	1MS	5MS/CM	Less than 47 MS	---
21.	5 CPS	CW	1MS	10MS/CM	Less than 95 MS	---
22.	5 CPS	CCW	1MS	50MS/CM	200MS(5CPS)	± 10%

Verification of Specifications Procedure (Repetition Rate)

REPETITION RATE SETTINGS

	REPETITION RATE SWITCH	REPETITION RATE VERNIER	WIDTH	SCOPE SWEEP SPEED	CORRECT SPACINGS	TOLERANCE
23.	2 CPS	CCW	1MS	0.1Sec/CM	0.5Sec(2 CPS)	± 10%
24.	2 CPS	CW	1MS	20MS/CM	Less than 190MS	----

25. Set pulse width control to 0.5μs.

Set pulse delay control to 0.5μs.

Set pulse repetition rate control; Vernier fully CCW.

Set sweep speed to 10μs/CM.

Expand sweep x 100.

26. View leading edge of 10th pulse and verify that jitter is less than 0.8CM (0.08%)

27. Set pulse repetition rate switch to EXT., Vernier fully CCW.

Set pulse width control to 0.5μs, Vernier fully CCW.

Apply 20V RMS sine wave at 500 KC to positive external trigger input jack.

Set sweep speed at 1μs/CM.

28. Verify triggering stability.

29. Remove sine wave input and apply 20V positive pulse (.1μs rise) 3MC sweep speed .1μs/CM.

Verify triggering stability.

30. Remove pulse input.

Set pulse width control to 10 MS, Vernier fully CW.

Sweep speed 2 MS/CM.

Verification of Specifications Procedure (Repetition Rate)

31. Depress single pulse push button.

    Verify occurrence of single pulse.

32. Set pulse width to 0.5μs, vernier CCW.

    Set pulse delay to 0.5μs, vernier CCW.

    Set pulse repetition rate to 2 MC, vernier CW.

    Set sweep speed to 0.1μs/CM.

33. View sync pulse; verify amplitude is greater than 20V.

34. Terminate sync into 100 ohm.

    Verify that amplitude is greater than 10V.

Pulse Delay

1. Set pulse width control to 1μs, vernier fully CW (Min.)

   Set polarity control to +, rise time fully CCW.

   Set attenuator controls fully CW.

   Terminate output pulse into 50 ohm.

   Sync scope from positive sync output.

   View output pulse and sync pulse simultaneously (dual trace)

   Sweep speed 0.1μs/CM Vertical sensitivity 20V/CM

   Note that delay is measured from the 50% point on leading edge of the sync pulse to the 50% point on the leading edge of the output pulse.

2. See Pulse Delay Setting Chart (2. through 19.).

Verification of Specifications Procedure (Pulse Delay)

PULSE DELAY SETTINGS

	REPETITION RATE	WIDTH	DELAY SWITCH	VERNIER	SCOPE SWEEP SPEED	CORRECT DELAY ± 10%
2.	1 KC	1μs	0.5μs	CCW	0.1μs/CM	APPROX. 0.2μs
3.	1 KC	1μs	0.5μs	CW	0.1μs/CM	0.5μs
4.	1 KC	1μs	1μs	CW	0.2μs/CM	1μs
5.	1 KC	1μs	2μs	CW	0.5μs/CM	2μs
6.	1 KC	1μs	5μs	CW	1μs/CM	5μs
7.	1 KC	1μs	10μs	CW	2μs/CM	10μs
8.	1 KC	1μs	20μs	CW	5μs/CM	20μs
9.	1 KC	1μs	50μs	CW	10μs/CM	50μs
10.	1 KC	1μs	0.1MS	CW	20μs/CM	0.1MS
11.	0.1 KC	1μs	0.2MS	CW	50μs/CM	0.2MS
12.	0.1 KC	1μs	0.5MS	CW	0.1MS/CM	0.5MS
13.	0.1 KC	1μs	1MS	CW	0.2MS/CM	1MS
14.	10CPS	0.1MS	2MS	CW	0.5MS/CM	2MS
15.	10CPS	0.1MS	2MS	CCW	0.1MS/CM	Less than 0.95MS
16.	10CPS	0.1MS	5MS	CCW	0.2MS/CM	Less than 1.9MS
17.	10CPS	0.1MS	5MS	CW	1MS/CM	5MS
18.	10CPS	0.1MS	10MS	CW	2MS/CM	10MS
19.	10CPS	0.1MS	10MS	CCW	0.5MS/CM	Less than 4.7MS

Verification of Specifications Procedure (Pulse Delay)

20. Set pulse repetition rate switch to 0.1KC sweep speed 2MS/CM.

    Slowly turn pulse delay vernier CW and verify that 70% duty cycle can be exceeded without circuit failure.

21. Set pulse delay switch to 1MS vernier fully CW.

    Set sweep speed at 0.2MS/CM.

    Expand sweep x 100 and view leading edge of pulse.

    Verify that jitter is less than 1/2 CM (0.05%).

IV MAINTENANCE INSTRUCTIONS

Verification of Specifications Procedure (Pulse Width)

1. Set pulse delay control to 0.5μs, vernier fully CCW.

   Set polarity control to +, rise time fully CCW.

   Set attenuator controls fully CW.

   Terminate output pulse into 50 ohm.

   Sync scope from positive sync output.

   View output pulse.

   Sweep speed 0.1μs/CM, vertical sensitivity 20V/CM.

   Note that width is measured from the 50% point on the leading edge of the output pulse to the 50% point on the laging edge of the output pulse.

2. See Pulse Width Setting Chart (2. through 19.)

IV MAINTENANCE INSTRUCTIONS

Verification of Specifications Procedure (Pulse Width)

PULSE WIDTH SETTINGS

	REPETITION RATE	PULSE WIDTH		SCOPE SWEEP SPEED	CORRECT PULSE WIDTH ± 10%
		SWITCH	VERNIER		
2.	1 KC	0.5μs	CCW	0.1μs/CM	APPROX. 0.5μs
3.	1 KC	0.5μs	CW	0.1μs/CM	0.5μs
4.	1 KC	1μs	CW	0.2μs/CM	1μs
5.	1 KC	2μs	CW	0.5μs/CM	2μs
6.	1 KC	5μs	CW	1μs/CM	5μs
7.	1 KC	10μs	CW	2μs/CM	10μs
8.	1 KC	20μs	CW	5μs/CM	20μs
9.	1 KC	50μs	CW	10μs/CM	50μs
10.	1 KC	0.1MS	CW	20μs/CM	0.1MS
11.	0.1 KC	0.2MS	CW	50μs/CM	0.2MS
12.	0.1 KC	0.5MS	CW	0.1MS/CM	0.5MS
13.	0.1 KC	1 MS	CW	0.2MS/CM	1 MS
14.	10 CPS	2 MS	CW	0.5MS/CM	2 MS
15.	10 CPS	2 MS	CCW	0.1MS/CM	Less than 0.95 MS
16.	10 CPS	5 MS	CCW	0.2MS/CM	Less than 1.9 MS
17.	10 CPS	5 MS	CW	1 MS/CM	5 MS
18.	10 CPS	10 MS	CW	2 MS/CM	10 MS
19.	10 CPS	10 MS	CCW	0.5MS/CM	Less than 4.7 MS

IV MAINTENANCE INSTRUCTIONS

Verification of Specifications Procedure (Pulse Width)

20. Set pulse width switch to 1 MS vernier fully CW.

Set sweep speed at 0.2MS/CM.

Expand sweep x 100 and view laging edge of pulse.

Verify that jitter is less than 1/2 CM (0.05%).

IV MAINTENANCE INSTRUCTIONS

Verification of Specifications Procedure (Output Waveform)

1. Set pulse repetition rate switch to 2 MC; Vernier fully CW.
   Set pulse delay to 0.5μs; Vernier fully CCW.
   Set pulse width to 0.5μs; Vernier fully CCW.
   Set polarity to +; rise time fully CCW.
   Set attenuator controls fully CW.
   Sync scope from positive sync output.
   View output pulse terminated into 50 ohm.
   Sweep speed 0.1μs/CM; vertical sensitivity 20V/CM.

2. Observe that amplitude is equal to or greater than 50V.

3. Set polarity to -.
   Observe that amplitude is equal to or greater than 50V.

4. Set polarity to +.

5. Step attenuator to 10 dB in 2 dB steps and observe with full amp. 60V.

   2 dB amplitude is 48V ± 10%.

   4 dB amplitude is 38V ± 10%.

   6 dB amplitude is 30V ± 10%.

   8 dB amplitude is 24V ± 10%.

   10 dB amplitude is 19V ± 10%.

6. Return control fully CW.

7. Step attenuator to 50 dB in 10 dB steps. Observe.

   10 dB amplitude is 19V ± 10%.

   20 dB amplitude is 6V ± 10%.

   30 dB amplitude is 1.9V ± 10%.

   40 dB amplitude is 0.6V ± 10%.

   50 dB amplitude is 0.19V ± 10%.

Verification of Specifications Procedure (Output Waveform)

8. Return control fully CW.

9. Set repetition rate control to 10KC; vernier fully CCW.

   Set pulse width to 1μs; vernier fully CW.

10. Observe overshoot is less than 4% (it may be necessary to trim overshoot somewhat with rise time control).

11. Set rise time control fully CW.

    Observe that rise time is greater than 0.5μs.

12. Set repetition rate to 50 CPS.

    Set pulse width to 1MS, sweep speed 0.2MS/CM.

13. Observe top slope is less than 3%.

14. Set repetition rate to 10 KC.

    Set pulse width to 0.5μs; vernier fully CCW.

    Observe output waveform terminated into 50 ohm on sampling oscilloscope.

15. Observe that rise and decay time are equal to or less than 10 nanoseconds (from 10% to 90% point on leading edge and lagging edge respectively.

16. De-energize equipment. Using a device such as Vector T80C, insert an ammeter in plate circuit of V27 taking care that both halves of tube are connected through the ammeter. Connect a voltmeter from TP10 (+225V) to ground.

Verification of Specifications Procedure (Output Waveform)

17. Energize equipment.

18. Set pulse repetition rate to 0.1MC, vernier centered.

    Set pulse delay to 0.5μs; vernier fully CCW.

    Set pulse width to 2μs; vernier fully CCW.

19. Slowly turn pulse width vernier CW noting ammeter reading.

    Verify that average pulse current overload lamp lights at approximately 220MA.

20. Continue increasing duty cycle and note that +225V supply decreases in voltage at 225MA.

21. De-energize equipment and remove ammeter and voltmeter.

IV MAINTENANCE INSTRUCTIONS

VOLTAGE & RESISTANCE TABLES

PIN	V1 6DJ8 VOLTAGE	RESISTANCE	PIN	V2 6DJ8 VOLTAGE	RESISTANCE
1	+70V	150K	1	+100V	100K
2	ZERO	10K	2	-5.6V	5K
3	+25V	780 ohm	3	ZERO	ZERO
4	ZERO	ZERO	4	ZERO	ZERO
5	6.3 VAC	ZERO	5	6.3 VAC	ZERO
6	+75V	100K	6	+100V	100K
7	+25	1K	7	-5.6V	400 ohm
8	+25	780 ohm	8	ZERO	470 ohm
9	---	---	9	---	---

PIN	V3 6DJ8 VOLTAGE	RESISTANCE	PIN	V4 6DJ8 VOLTAGE	RESISTANCE
1	+10V	130K	1	+2V	200K
2	ZERO	200K	2	ZERO	∞
3	ZERO	ZERO	3	ZERO	50 ohm
4	6.3 VAC	ZERO	4	6.3 VAC	ZERO
5	ZERO	ZERO	5	ZERO	ZERO
6	+100V	100K	6	+100V	100K
7	ZERO	470 ohm	7	-4V	150K
8	+3V	470 ohm	8	ZERO	50 ohm
9	---	---	9	---	---

VOLTAGE & RESISTANCE TABLES

V5 6DJ8			V6 6DJ8		
PIN	VOLTAGE	RESISTANCE	PIN	VOLTAGE	RESISTANCE
1	+100V	100K	1	+2V	200K
2	-5.6V	3K	2	ZERO	∞
3	ZERO	ZERO	3	ZERO	50 ohm
4	ZERO	ZERO	4	6.3 VAC	ZERO
5	6.3 VAC	ZERO	5	ZERO	ZERO
6	+100V	100K	6	+100V	100K
7	-5.6V	500 ohm	7	-4V	150K
8	0	3 ohm	8	ZERO	50 ohm
9	--	--	9	--	--

V7 6DJ8			V8 6DJ8		
PIN	VOLTAGE	RESITANCE	PIN	VOLTAGE	RESISTANCE
1	+100V	100K	1	+100V	100K
2	-5.6V	3K	2	-5.6V	1.5K
3	ZERO	ZERO	3	ZERO	ZERO
4	6.3 VAC	ZERO	4	ZERO	ZERO
5	ZERO	ZERO	5	6.3 VAC	ZERO
6	+100V	100K	6	+100V	100K
7	-5.6V	1K	7	-5.6V	1K
8	ZERO	3 ohm	8	ZERO	ZERO
9	--	--	9	ZERO	ZERO

VOLTAGE & RESISTANCE TABLES

V9 7119			V10 7119		
PIN	VOLTAGE	RESISTANCE	PIN	VOLTAGE	RESISTANCE
1	+225V	300K	1	+225V	300K
2	-18V	100 ohm	2	-18V	10 ohm
3	ZERO	ZERO	3	ZERO	ZERO
4	6.3 VAC	ZERO	4	6.3 VAC	ZERO
5	6.3 VAC	ZERO	5	6.3 VAC	ZERO
6	ZERO	ZERO	6	ZERO	ZERO
7	-18V	10 ohm	7	-18V	10 ohm
8	ZERO	ZERO	8	ZERO	ZERO
9	+225V	300K	9	+225V	300K

V11 7119			V12 7119		
PIN	VOLTAGE	RESISTANCE	PIN	VOLTAGE	RESISTANCE
1	+225V	300K	1	+2V	300K
2	-18V	10 ohm	2	-18V	10 ohm
3	ZERO	ZERO	3	ZERO	ZERO
4	6.3 VAC	ZERO	4	6.3 VAC	ZERO
5	6.3 VAC	ZERO	5	6.3 VAC	ZERO
6	ZERO	ZERO	6	ZERO	ZERO
7	-18V	10 ohm	7	-18V	10 ohm
8	ZERO	ZERO	8	ZERO	ZERO
9	+225V	300K	9	+12V	10K

VOLTAGE & RESISTANCE TABLES

V13 7119			V14 6AU6		
PIN	VOLTAGE	RESISTANCE	PIN	VOLTAGE	RESISTANCE
1	ZERO	ZERO	1	ZERO	∞
2	ZERO	ZERO	2	ZERO	ZERO
3	+2V	300K	3	6.3 VAC	ZERO
4	6.3 VAC	ZERO	4	ZERO	ZERO
5	6.3 VAC	ZERO	5	+2V	300K
6	+2V	300K	6	+100V	100K
7	ZERO	ZERO	7	ZERO	ZERO
8	ZERO	ZERO			
9	ZERO	ZERO			

V15 7119			V16 12BH7		
PIN	VOLTAGE	RESISTANCE	PIN	VOLTAGE	RESISTANCE
1	+225V	300K	1	ZERO	ZERO
2	+2V	300K	2	-40	300K
3	+12V	10K	3	-40V	150K
4	6.3VAC	ZERO	4	3.15 VAC	ZERO
5	6.3 VAC	ZERO	5	3.15 VAC	ZERO
6	+12V	10K	6	+150V	500K
7	+2V	300K	7	+150V	500K
8	ZERO	ZERO	8	+150V	∞
9	+225V	300K	9	3.15 VAC	ZERO

VOLTAGE & RESISTANCE TABLES

V17 6DQ5			V18 6DQ5		
PIN	VOLTAGE	RESISTANCE	PIN	VOLTAGE	RESISTANCE
1	-40	150K	1	-40V	150K
2	3.15 VAC	ZERO	2	3.15 VAC	ZERO
3	ZERO	50 ohm	3	ZERO	50 ohm
4	+150V	∞	4	+150V	∞
5	-40V	150K	5	-40V	150K
6	ZERO	50 ohm	6	ZERO	50 ohm
7	3.15 VAC	ZERO	7	3.15 VAC	ZERO
8	150V	∞	8	+150V	∞
Plate cap	+150V	500K	Plate cap	+150V	500K

V19 OB2			V20 6AU6		
PIN	VOLTAGE	RESISTANCE	PIN	VOLTAGE	RESISTANCE
1	ZERO	ZERO	1	-30V	200K
2	-105	3.5K	2	ZERO	ZERO
3	ZERO	∞	3	6.3 VAC	ZERO
4	-105	3.5K	4	ZERO	ZERO
5	ZERO	ZERO	5	+75V	1.5M
6	ZERO	∞	6	+85V	100K
7	-105	3.5K	7	ZERO	ZERO

IV MAINTENANCE INSTRUCTIONS

VOLTAGE & RESISTANCE TABLES

V21 6AS7			V22 6U8A		
PIN	VOLTAGE	RESISTANCE	PIN	VOLTAGE	RESISTANCE
1	+75V	1.5M	1	+45V	100K
2	+200V	100K	2	-10V	400K
3	+100V	100K	3	+100V	100K
4	+75V	1.5M	4	6.3 VAC	ZERO
5	+200V	100K	5	ZERO	ZERO
6	+100V	100K	6	+150V	1.5M
7	ZERO	ZERO	7	ZERO	ZERO
8	6.3 VAC	ZERO	8	ZE RO	ZERO
			9	ZERO	400K

V23 6AS7			V24 6U8A		
PIN	VOLTAGE	RESISTANCE	PIN	VOLTAGE	RESISTANCE
1	+130V	1.5M	1	+100V	100K
2	+320V	200K	2	-10V	200K
3	+225V	300K	3	+130V	100K
4	+130V	1.5M	4	6.3 VAC	ZERO
5	+320V	200K	5	ZERO	ZERO
6	+225V	300K	6	+130V	1.5M
7	6.3 VAC	ZERO	7	ZERO	ZERO
8	ZERO	ZERO	8	ZERO	ZERO
9	--	--	9	-4V	250K

VOLTAGE & RESISTANCE TABLES

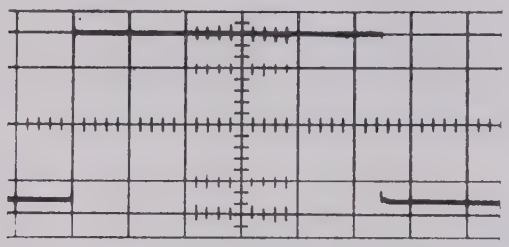
V25 OB2			V26 6AU6		
PIN	VOLTAGE	RESISTANCE	PIN	VOLTAGE	RESISTANCE
1	ZERO	ZERO	1	-4V	100K
2	-105	20K	2	ZERO	ZERO
3	ZERO	∞	3	6.3 VAC	ZERO
4	-105	20K	4	ZERO	ZERO
5	ZERO	ZERO	5	+65V	1.5M
6	ZERO	∞	6	+125V	80K
7	-105	20K	7	ZERO	ZERO

V27 6AS7					
PIN	VOLTAGE	RESISTANCE	PIN	VOLTAGE	RESISTANCE
1	+65V	1.5M			
2	+250V	100K			
3	+150V	500K			
4	+65V	1.5M			
5	+250V	100K			
6	+150V	500K			
7	ZERO	ZERO			
8	6.3 VAC	ZERO			

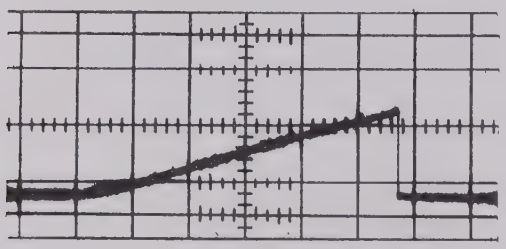
WAVEFORM SUMMARY

TROUBLE SHOOTING AIDS
Sweep Speed 0.2us/cm
Vertical Sensitivity 20v/cm

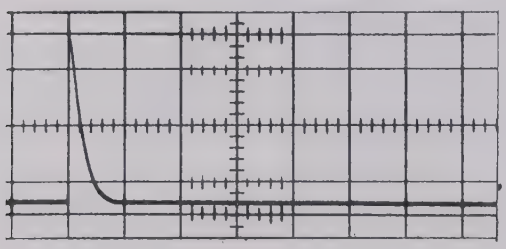
Proper Waveform



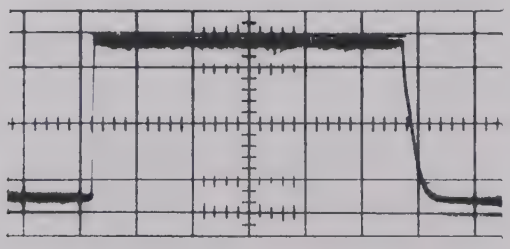
Loss of Leading Trigger; Check V8A, V10, V11, or V13



Loss of Duration Gate; Check V6 or V14

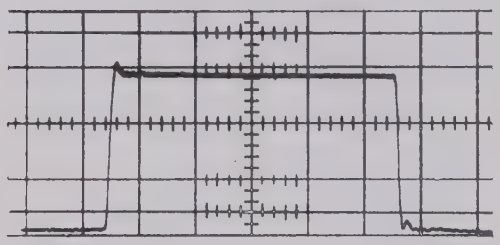


Loss of Trailing Edge Trigger; Check V7, V8B, V9 or V12

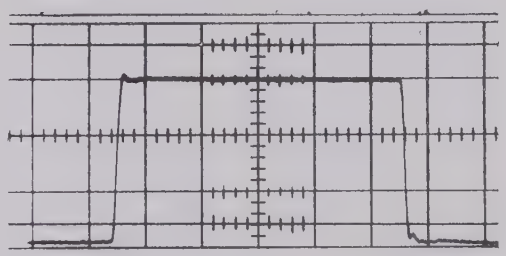


CONTROLS FOR WAVEFORM TIMING
Sweep Speed 0.2us/cm
Vertical Sensitivity 20v/cm

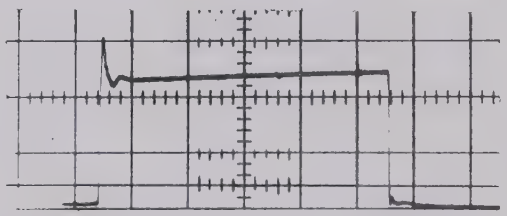
Rise Time not Compensated



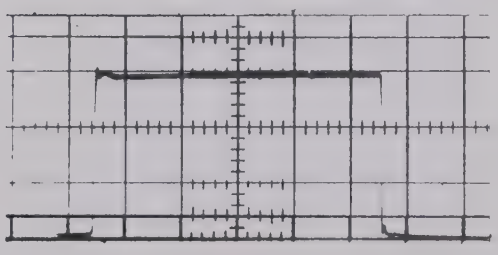
Rise Time Control Turned Slightly Cw (Proper Waveform)



Overshoot C34 Overcompensated



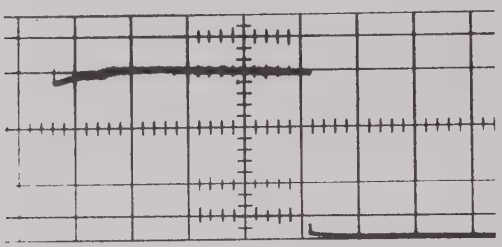
Overshoot C34 Undercompensated



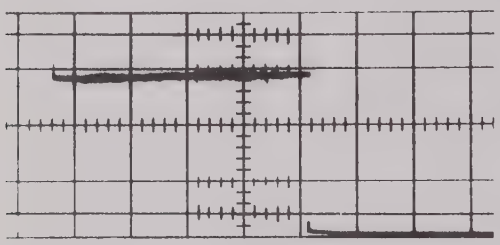
CONTROLS FOR WAVEFORM TIMING

Sweep Speed 2 us/cm
Vertical Sensitivity 20v/cm

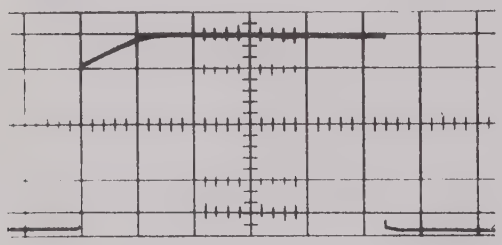
Roll C39
Over Compensated



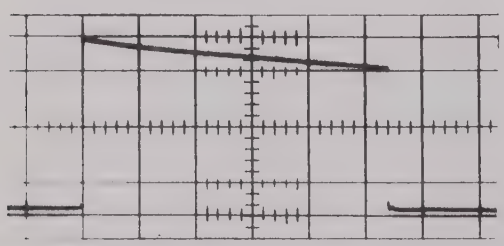
Roll C39
Under Compensated



Sweep Speed 20 us/cm
Vertical Sensitivity 20v/cm
Top Slope R260 Over Compensated



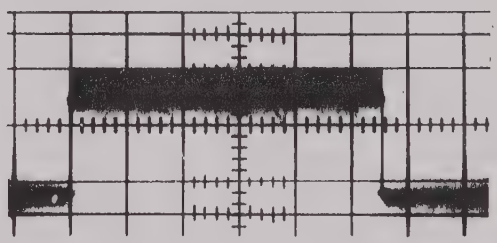
Top Slope R260 Under Compensated



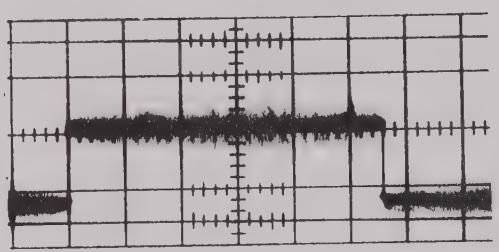
EFFECT OF AVERAGE PULSE CURRENT OVERLOAD CIRCUIT

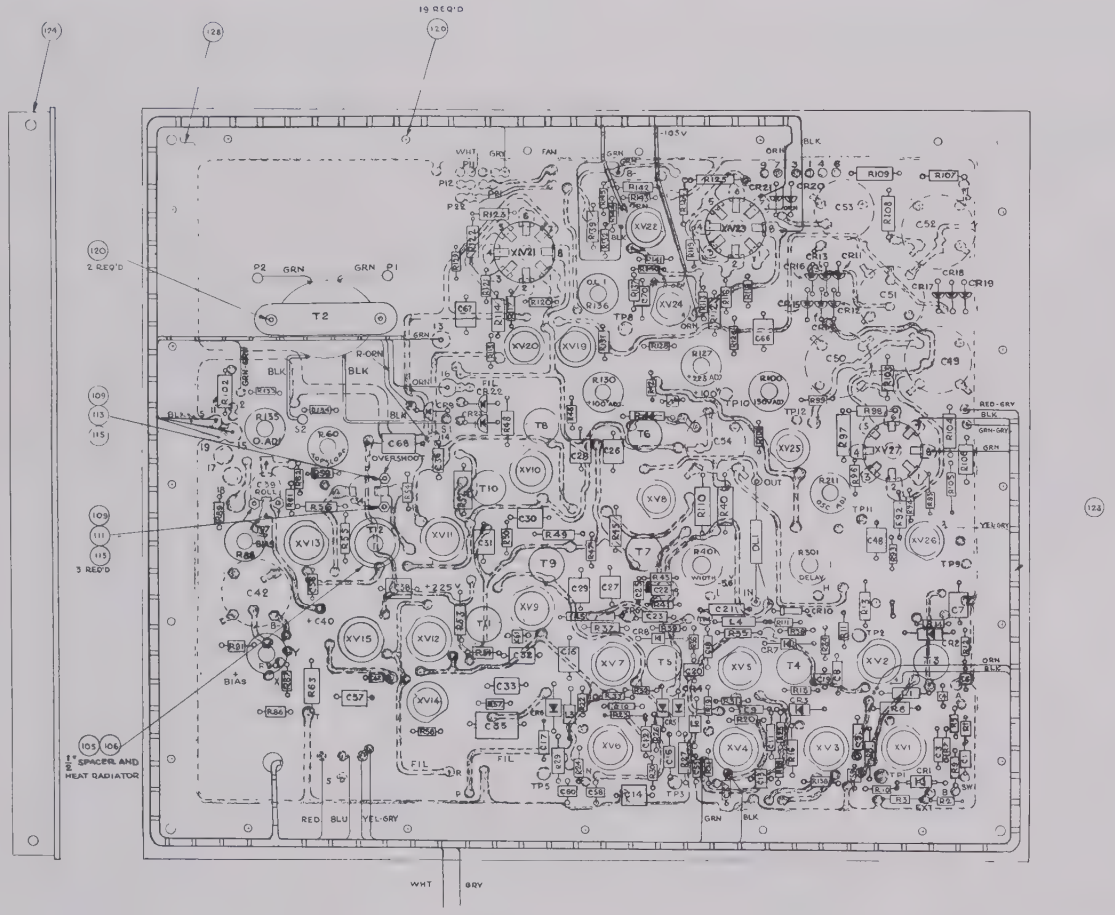
10 us/cm Sweep Speed
Vertical Sensitivity 20v/cm

Slight Overload



Extreme Overload





RESISTORS

REF DES	ITEM Nº	VALUE
R1	21	47Ω
R2	6	10K
R3	6	10K
R5	1	100Ω 1%
R6	31	154Ω 1%
R7	14	82K
R8	38	1K 2W
R9	5	1K
R10	10	180K
R11	18	33K
R12	21	47Ω
R13	34	470Ω 1W
R14	12	220Ω
R15	5	1K
R16	34	470Ω 1W
R19	7	100K
R20	16	27K
R21	2	47Ω 5%
R22	7	100K
R23	16	27K
R24	2	47Ω 5%
R25	6	10K
R26	6	10K
R27	43	470Ω 2W
R28	17	270K
R29	43	470Ω 2W
R30	17	270K
R31	13	2.2K
R32	5	1K
R33	13	2.2K
R34	21	47Ω
R35	34	470Ω 1W
R36	21	47Ω
R37	34	470Ω 1W
R38	12	220Ω
R39	5	1K
R40	43	470Ω 2W
R41	8	3.3K
R42	21	47Ω
R43	21	47Ω
R44	43	470Ω 2W
R45	43	470Ω 2W
R46	21	47Ω
R47	21	47Ω
R48	43	470Ω 2W
R49	43	470Ω 2W
R50	21	47Ω
R51	21	47Ω
R52	43	470Ω 2W
R53	43	470Ω 2W
R54	11	2.2Ω
R55	44	680Ω 2W
R56	44	680Ω 2W
R57	20	3.3K
R58	11	2.2Ω
R59	15	220K
R60	45	360Ω 2W
R61	7	100K
R62	24	68K
R63	39	10Ω 2W
R68	41	330Ω
R86	7	100K
R87	7	100K
R88	45	250K 5W
R89	7	100K
R90	45	250K 5W
R91	7	100K
R92	30	100Ω 1W
R93	7	100K
R94	8	M
R95	21	47Ω

RESISTORS

REF DES	ITEM Nº	VALUE
R96	21	47Ω
R97	37	11Ω 1W
R98	32	4.7Ω 1W
R99	7	100K
R100	45	250K 5W
R101	24	68K
R102	38	1K 2W
R103	32	22Ω 1W
R104	42	33KW
R105	42	33KW
R106	42	33KW
R107	32	22Ω 1W
R108	38	1KW
R109	38	1KW
R110	40	470Ω 10W
R112	30	100K 1W
R113	30	100K 1W
R114	30	100K 1W
R115	30	100K 1W
R116	8	1M
R117	8	1M
R118	21	47Ω
R119	21	47Ω
R120	21	47Ω
R121	21	47Ω
R122	32	22Ω 1W
R123	32	22Ω 1W
R124	32	22Ω 1W
R125	32	22Ω 1W
R126	23	470K 2W
R127	45	250K 5W
R128	7	100K
R129	7	100K
R130	45	250K 5W
R131	7	100K
R132	15	220K
R133	9	1.5M
R134	7	100K 2W
R135	45	250K 5W
R136	45	250K 5W
R137	15	220K
R138	19	3.5K
R139	29	10K 1W
R140	23	470K 2W
R141	25	680K 1W
R142	29	10K 1W
R143	23	470K 2W
R144	25	680K 1W
R145	21	47Ω
R211	45	250K 5W
R301	45	250K 5W
R401	45	250K 5W

CAPACITORS

REF DES	ITEM Nº	VALUE
C1	61	.01μF
C2	59	.1μF
C3	50	2Γ
C4	61	.01μF
C5	48	100
C6	61	.01μF
C7	59	.1μF
C8	47	470 300
C9	81	47
C10	51	47
C11	49	15
C12	49	15
C13	61	.006F
C14	59	.1μF
C15	59	.1μF
C16	51	47
C17	51	47
C18	47	470 300
C19	61	.01μF
C20	61	.01μF
C21	54	1000
C22	61	.01μF
C23	47	470 300
C24	61	.01μF
C25	61	.01μF
C26	59	.1μF
C27	59	.1μF
C28	59	.1μF
C29	59	.1μF
C30	59	.1μF
C31	59	.1μF
C32	59	.1μF
C33	59	.1μF
C35	57	.5μF
C36	59	.1μF
C37	58	.1μF
C38	59	.1μF
C44	61	.01μF
C46	59	.1μF
C55	61	.01μF
C56	61	.01μF
C57	61	.01μF
C58	61	.01μF
C59	61	.01μF
C60	61	.01μF
C61	61	.01μF
C62	61	.01μF
C66	59	.1μF
C67	59	.1μF
C68	59	.1μF
C70	59	.1μF

TUBE SOCKETS

REF DES	ITEM Nº	VALUE
XV1	100	9-338
XV2	97	9-316
XV3	99	9-360
XV4	100	9-338
XV5	97	9-316
XV6	100	9-338
XV7	97	9-316
XV8	103	9-NO
XV9	101	9-320
XV10	101	9-320
XV11	98	9-327
XV12	98	9-327
XV13	98	9-327
XV14	98	9-327
XV15	98	9-327
XV19	99	9-NO
XV20	91	7-327
XV21	84	8-NO
XV22	102	9-370
XV23	94	8-NO
XV24	103	9-NO
XV25	92	7-NO
XV26	91	7-327
XV27	94	8-NO

DIODES

CR1	74	IN34A
CR2	74	IN34A
CR3	74	IN34A
CR4	74	IN34A
CR5	74	IN34A
CR6	74	IN34A
CR7	74	IN34A
CR8	74	IN34A
CR9	78	IN2482
CR10	76	IN1520
CR11	79	IN2485
CR12	79	IN2486
CR13	79	IN2483
CR14	79	IN2485
CR15	79	IN2485
CR16	79	IN2483
CR17	80	IN2484
CR18	80	IN2484
CR19	80	IN2484
CR20	79	IN2483
CR21	79	IN2485
CR22	78	IN2482
CR23	78	IN2482

TEST LUGS

TP1	122	
TP2	122	
TP3	122	
TP4	22	
TP5	122	
TP6	122	
TP7	22	
TP8	22	
TP9	22	
TP10	122	
TP11	122	
TP12	122	

TRANSFORMERS

T2	83	FIST
T3	125	1:1
T4	125	1:1
T5	128	1:1
T6	126	2:1
T7	126	2:1
T8	126	2:1
T9	126	2:1
T10	126	2:1
T11	126	2:1
T12	126	2:1

INDUCTORS

L1	87	15μH
L2	87	15μH
L3	87	15μH
L4	88	25μH
L5	88	25μH

DELAY LINE

DL1	65	.03μ 500Ω

3. ALL CAPACITOR VALUES ARE IN μμf
2. ALL RESISTOR VALUES ARE ½W 10%
1. DOTTED LINES INDICATE COMPONENTS ON OTHER SIDE.

NOTE: UNLESS OTHERWISE SPECIFIED,

REVISIONS

ECN	SYM	DESCRIPTION	DATE	APPROVAL

REQD | PART NO. | DESCRIPTION | ITEM

LIST OF MATERIALS

FOR PART REQUIREMENTS SEE LIST OF MAT'L 37000-002

37000-009	M-02	1
NEXT ASSY	USED ON	NEXT ASSY	FINAL ASSY
APPLICATION		QTY REQD

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
3 PLACE DEC. ± 2 PLACE DEC. ± ANGLES ±
MATERIAL
FINISH
DO NOT SCALE DWG.

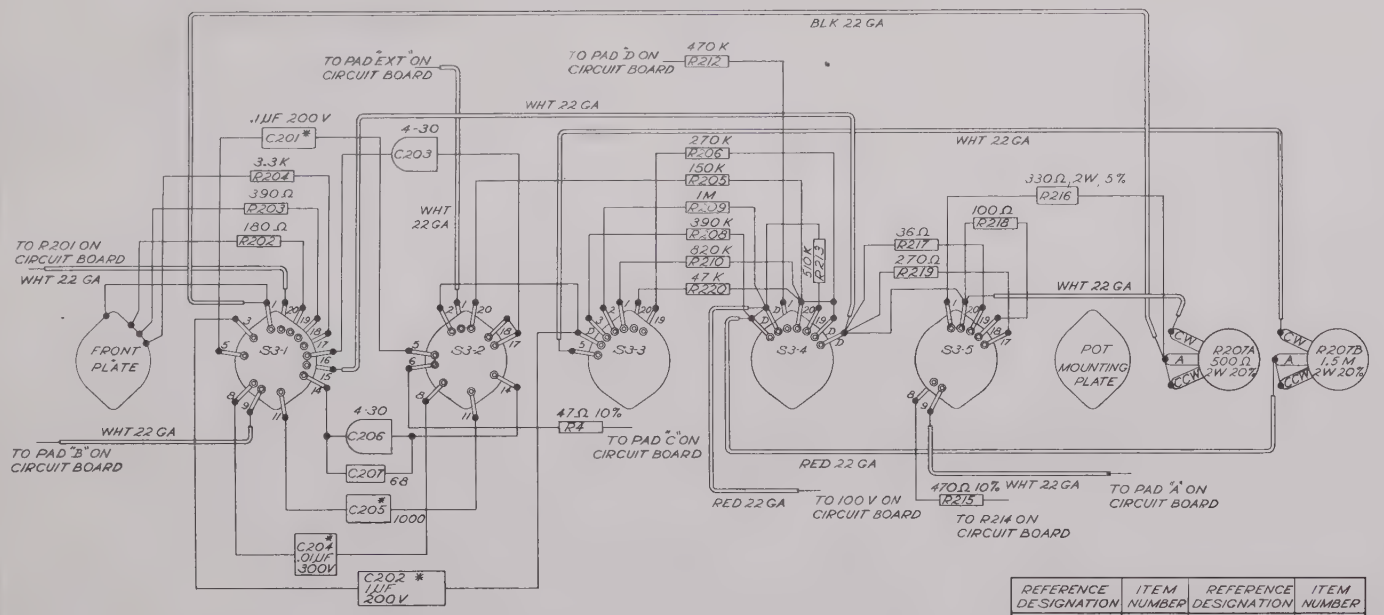
DRAWN G. Sawyer 9 8 61
CHECKED W. Overall
APPROVED M.A. Starkweather
APPROVED
APPROVED
RELEASED

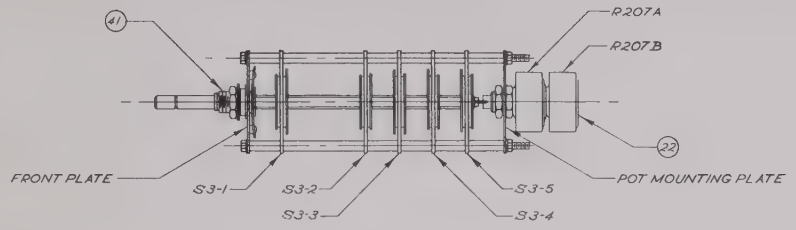
TITLE
SUBASSEMBLY -
CIRCUIT BOARD
FACE SIDE
MODEL 102
SCALE 1:1

DATAPULSE, INC
INGLEWOOD, CALIFORNIA

DWG NO. D 37000-002
SHEET 1 OF 1

37000-002





REFERENCE DESIGNATION	ITEM NUMBER	REFERENCE DESIGNATION	ITEM NUMBER
R4	20	C201	37
R202	4	C202	38
R203	11	C203	34
R204	9	C204	29
R205	3	C205	31
R206	7	C206	34
R207 A&B	22	C207	25
R208	13		
R209	2		
R210	16		
R212	17		
R213	15		
R215	21		
R216	19		
R217	10		
R218	1		
R219	6		
R220	14		

FOR PART REQIREMENTS SEE LIST OF MATERIAL 37000-005

REQD	PART NO.	DESCRIPTION	ITEM
		LIST OF MATERIALS	

3. ALL CAPACITOR VALUES ARE IN UF 500V 5%
2. ALL RESISTOR VALUES ARE ½ W 5%
1. * INDICATES COMPONENT VALUES MATCHED WITHIN 1% OF EACH OTHER.

NOTES: UNLESS OTHERWISE SPECIFIED

REVISIONS					
ECN	SYM	DESCRIPTION	DATE	APPROVAL
1	A	R216 19,330 Ω WAS 680 Ω	11 Dec 61	B Balenge

37000-005	M-102	1	1
NEXT ASSY	USED ON	NEXT ASSY	FINAL ASSY
APPLICATION		QTY REQD	

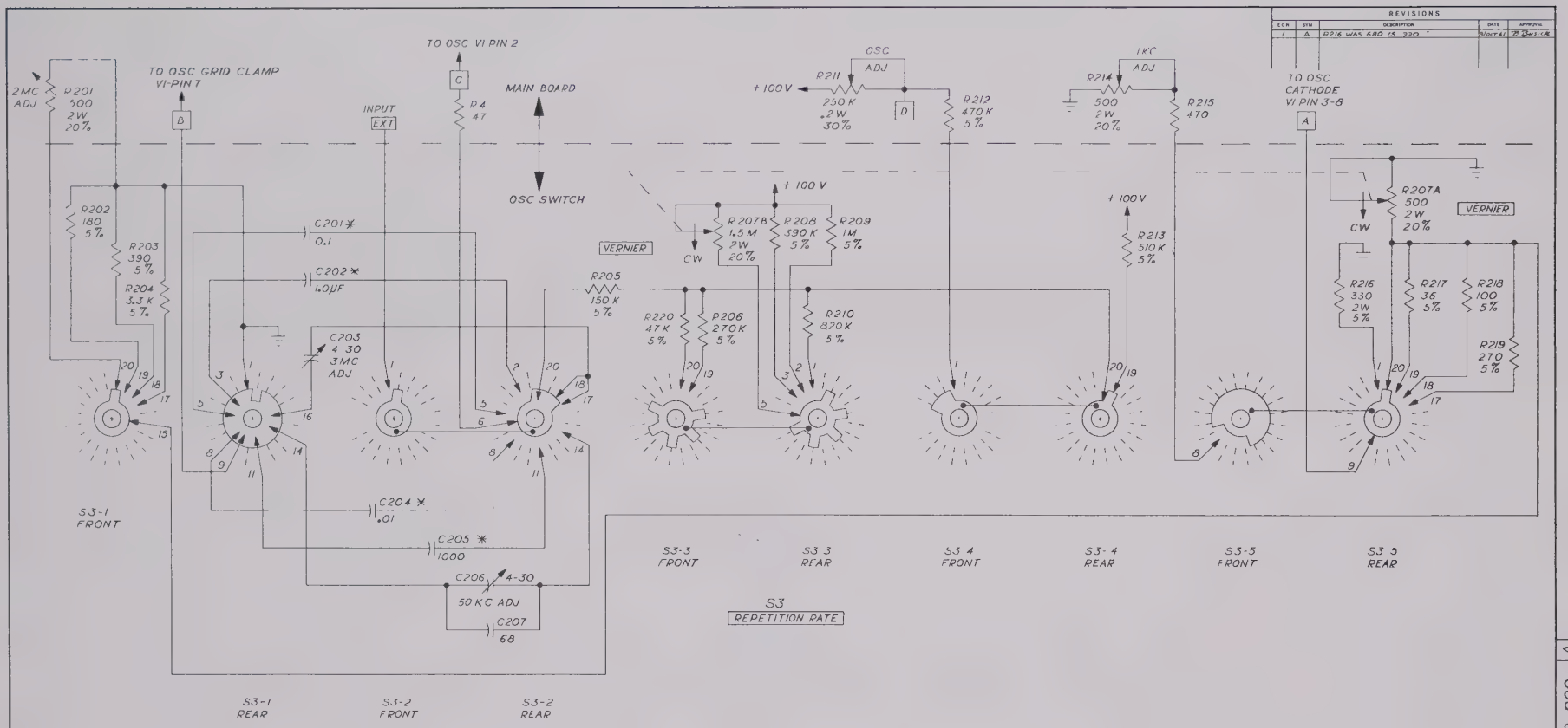
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES; TOLERANCES ON: X ± 1 PLACE DEC., .X ± 1 PLACE DEC., ANGLES ±; MATERIAL; FINISH; DO NOT SCALE DWG.

DRAWN C CANADOS 13 Sept 61
CHECKED B Bassick 14 Sept 61
APPROVED H A Stoffregen Jr 18 Sept 61
APPROVED
RELEASED B Bassick 20 Sept 61

TITLE: S3 ASSEMBLY-OSCILLATOR RANGE SWITCH
MODEL-102
SCALE NONE

DATAPULSE INC. HAWTHORNE CALIFORNIA

DWG NO. 37000-005 | A
SIZE D
SHEET 1 OF 1



* INDICATES COMPONENT VALUES MATCHED WITHIN 1% OF EACH OTHER.

6. ROTOR BLADES OF SWITCH ARE SHOWN IN EXTREME CW POSITION (2MC)
5. BOXED LETTERS INDICATE SPECIFIC LABELED EYELETS ON CIRCUIT BOARD.
4. BOXED WORDING INDICATES FRONT PANEL NOMENCLATURE.
3. ALL CAPACITOR VALUES LESS THAN ONE ARE IN µF.
2. ALL CAPACITOR VALUES GREATER THAN ONE ARE IN µµF.
1. ALL RESISTOR VALUES ARE IN OHMS, ½ W, 10%.

NOTES: UNLESS OTHERWISE SPECIFIED

FOR PART REQUIREMENTS SEE LIST OF MATERIAL 37000-005

REVISIONS				
ECN	STM	DESCRIPTION	DATE	APPROVAL
1	A	R216 WAS 680 1% 320	9 OCT 61	

REQD	PART NO.	DESCRIPTION	ITEM
LIST OF MATERIALS			

C201	C207		H40000-000	M402		
R201	R220		NEXT ASSY	USED ON	NEXT ASSY	FINAL ASSY
FIRST USED	LAST USED	OMIT TED	APPLICATION		QTY REQD	
REFERENCE DESIGNATIONS						

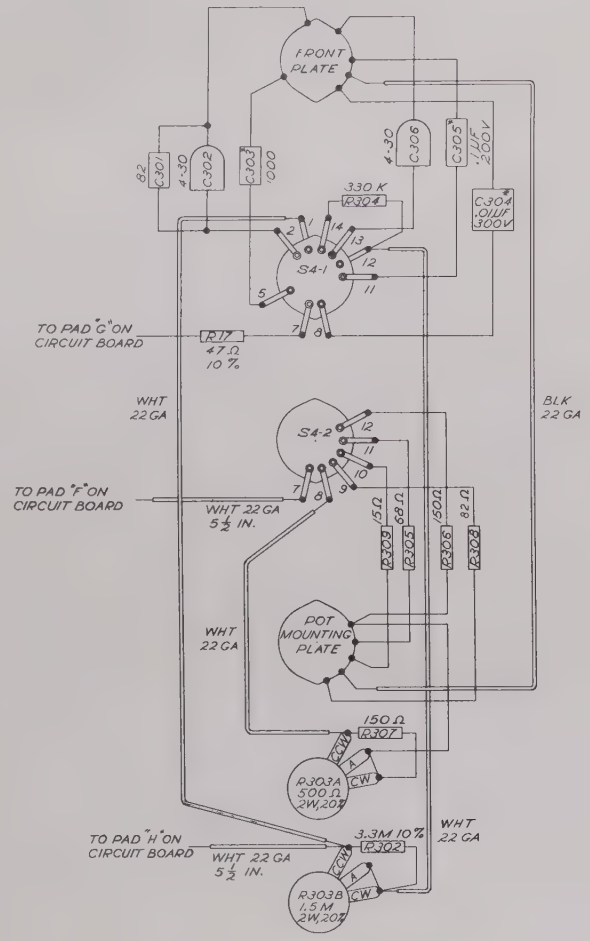
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES; TOLERANCES ON 1 PLACE DEC. ±, 2 PLACE DEC. ±, ANGLES ±; MATERIAL; FINISH; DO NOT SCALE DWG.

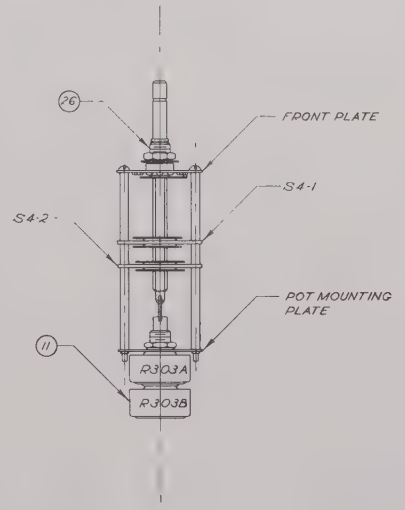
DRAWN GRANADOS 7/16/61
CHECKED E. Burrick 30 Aug 61
APPROVED [illegible] 12 Sept 61
APPROVED [illegible]
APPROVED
RELEASED E. Burrick 20 Sept 61

TITLE: SCHEMATIC 3MC OSCILLATOR SWITCH
MODEL 102
SCALE NONE
SIZE D
DWG NO 40000-001
SHEET OF

DATAPULSE, INC. INGLEWOOD CALIFORNIA

40000-000 A





REFERENCE DESIGNATION	ITEM NUMBER
R17	9
R302	8
R303 A & B	11
R304	4
R305	5
R306	2
R307	2
R308	3
R309	1
C301	15
C302	19
C303	17
C304	16
C305	22
C306	19

REVISIONS

ECN	SYM	DESCRIPTION	DATE	APPROVAL
4	A	R308 IS 82 WAS 120	28 DEC 61	B. Smith

3. ALL CAPACITOR VALUES ARE IN μF 500 V 5%.
2. ALL RESISTOR VALUES ARE ½ W 5%.
1. * INDICATES COMPONENT VALUES MATCHED WITHIN 1% OF EACH OTHER.

NOTES: UNLESS OTHERWISE SPECIFIED

FOR PART REQUIREMENTS SEE LIST OF MATERIAL 37000-006

LIST OF MATERIALS

REQD	PART NO.	DESCRIPTION	ITEM

NEXT ASSY	USED ON	NEXT ASSY	FINAL ASSY
37000-009	M-102	1	
APPLICATION		QTY REQD	

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES; TOLERANCES ON 3 PLACE DEC. ± ; 2 PLACE DEC. ± ; ANGLES ± ; MATERIAL; FINISH; DO NOT SCALE DWG.

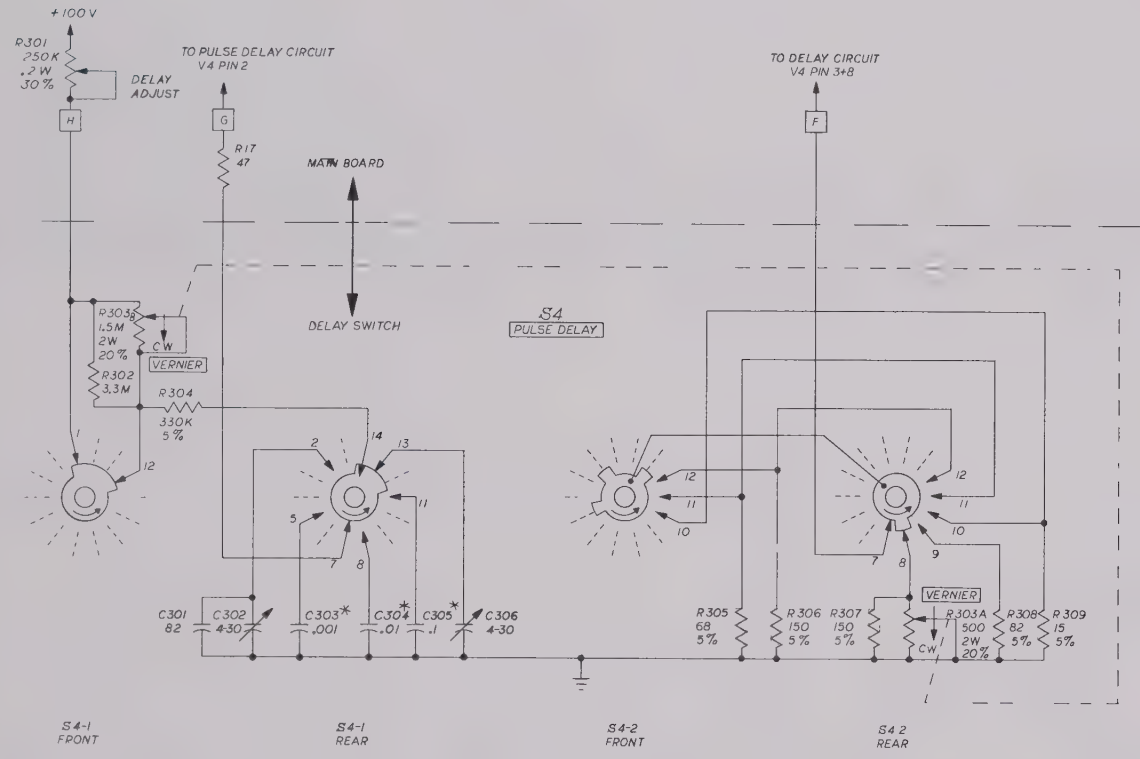
DRAWN GRANADOS 8 Sept 61
CHECKED J. Bristle 9 Sept 61
APPROVED H.A. Jefferson 9 Sept 61
APPROVED
APPROVED
RELEASED B. Smith 9 Sept 61

TITLE: S4 ASSEMBLY - PULSE DELAY SWITCH
MODEL-102
SCALE NONE

DATAPULSE, INC. INGLEWOOD CALIFORNIA

DWG 37000-006 REV A
SIZE D
SHEET 1 OF 1

REVISIONS				
E.C.N.	SYM	DESCRIPTION	DATE	APPROVAL
4	A	R308 IS 82 WAS 120	28 DEC 61	B Bostick



* INDICATES COMPONENT VALUES MATCHED WITHIN 1% OF EACH OTHER.

FOR PART REQUIREMENTS SEE LIST OF MATERIAL 37000-006

8. NUMBERS SURROUNDING ROTOR BLADES INDICATE CONTACT NUMBERS.
7. ARROW ON ROTOR BLADE INDICATES CLOCKWISE ROTATION.
6. ROTOR BLADES OF SWITCH ARE SHOWN IN EXTREME CCW POSITION (0.5US).
5. BOXED LETTERS INDICATES SPECIFIC LABELED EYELETS ON CIRCUIT BOARD.
4. BOXED WORDING INDICATES FRONT PANEL NOMENCLATURE.
3. ALL CAPACITOR VALUES LESS THAN ONE ARE IN µF.
2. ALL CAPACITOR VALUES GREATER THAN ONE ARE IN µµF.
1. ALL RESISTOR VALUES ARE IN OHMS, ½ W, 10%.

NOTES: UNLESS OTHERWISE SPECIFIED

REFERENCE DESIGNATION						
FIRST USED	LAST USED	OMITTED	H40000-000M-102			
C301 R301	C306 R309		NEXT ASSY	USED ON	NEXT ASSY	FINAL ASSY
			APPLICATION		QTY REQD	

LIST OF MATERIALS

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON 3 PLACE DEC. ±	2 PLACE DEC. ±	ANGLES ±	DRAWN	CRANADDS	7/16/61
MATERIAL			CHECKED	B Bostick	18 JUL 61
FINISH			APPROVED	H DW	18 JUL 61
DO NOT SCALE DWG.			APPROVED	M M Stafford	18 Sept 61
			APPROVED		
			RELEASED	B Bostick	20 Sept 61

TITLE: SCHEMATIC — PULSE DELAY SWITCH

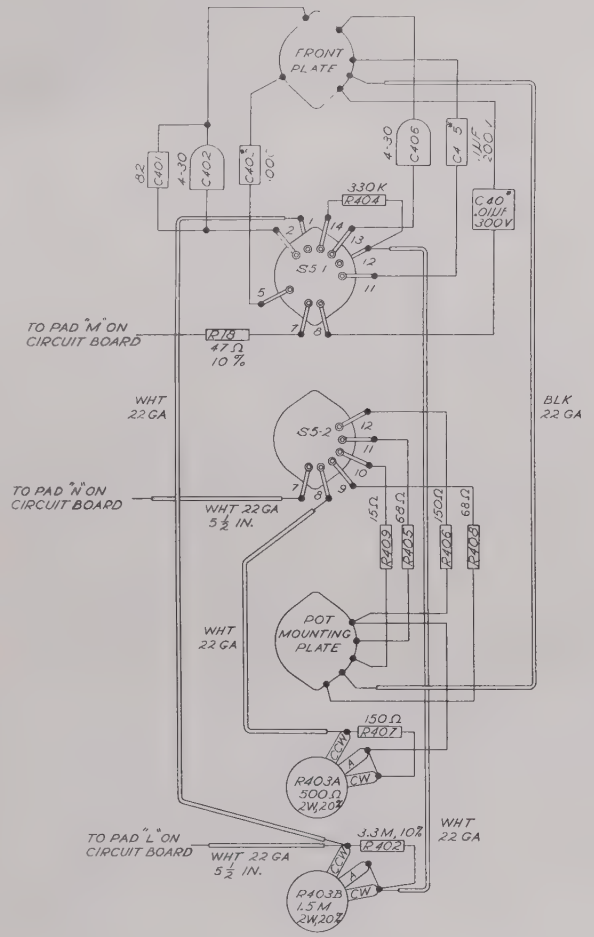
MODEL 102

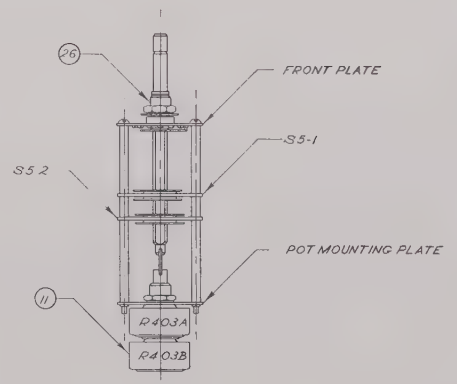
SCALE NONE

DATAPULSE, INC. INGLEWOOD CALIFORNIA

DWG 40000-002 | SIZE D | SHEET 1 OF 1

40000-002 | A





REFERENCE DESIGNATION	ITEM NUMBER
R18	9
R402	8
R403A&B	11
R404	4
R405	5
R406	2
R407	2
R408	3
R409	1
C401	15
C402	19
C403	17
C404	16
C405	22
C406	19

REVISIONS				
E.C.N.	ZONE	DESCRIPTION	DATE	APPROVAL
4	A	R408 IS 68 WAS 120	28 DEC 64	B Buslik

3. ALL CAPACITOR VALUES ARE IN μμF 500 V 5%.
2. ALL RESISTOR VALUES ARE ½ W 5%.
1. * INDICATES COMPONENT VALUES MATCHED WITHIN 1% OF EACH OTHER.

NOTES: UNLESS OTHERWISE SPECIFIED

FOR PART REQUIREMENTS SEE LIST OF MATERIAL 37000-007

LIST OF MATERIALS

NEXT ASSY	USED ON	NEXT ASSY	FINAL ASSY
37000-008	M-102		
APPLICATION		QTY REQD	

DO NOT SCALE DRWG.

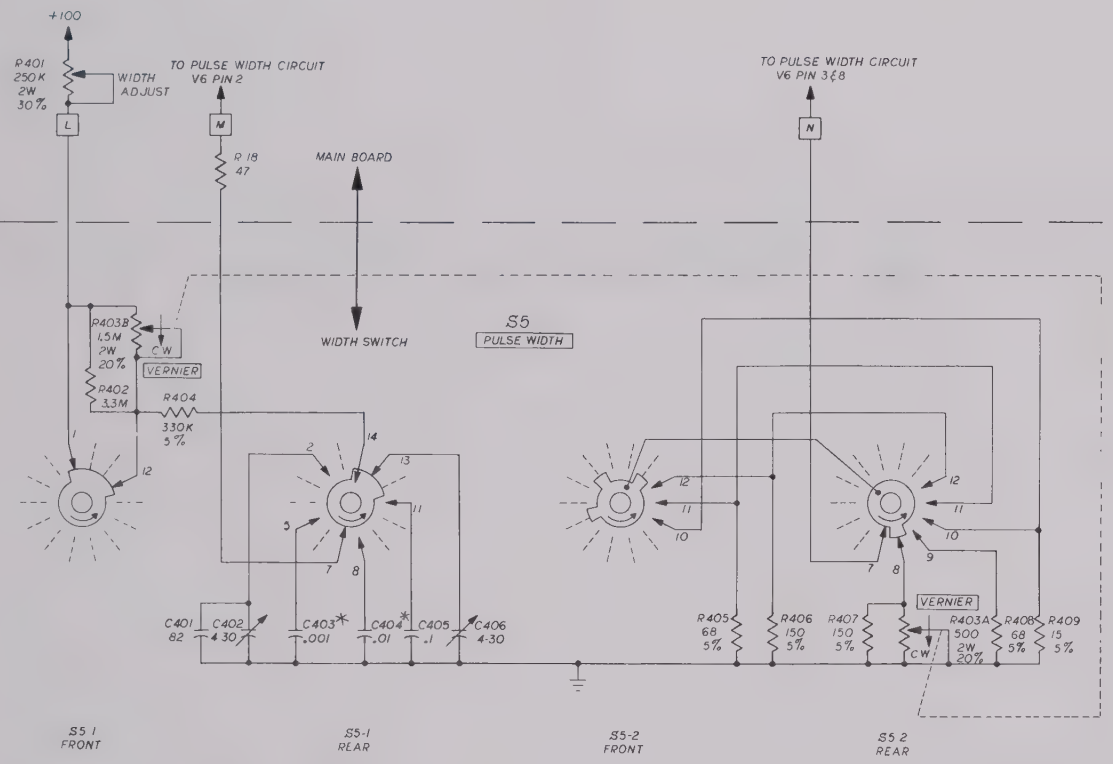
DRAWN G. RANADOS 9 Sep 64
CHECKED B. Buslik 9 Sep 64
APPROVED M. H. Strickler 9 Sep 64
APPROVED
APPROVED
RELEASED B. Buslik 30 Dec 64

TITLE: S5 ASSEMBLY - PULSE WIDTH SWITCH
MODEL-102
SCALE NONE

DATAPULSE, INC. INGLEWOOD, CALIFORNIA
DWG D 37000-007
SHEET 1 OF 1

37000-007 A

REVISIONS				
ECN	SYM	DESCRIPTION	DATE	APPROVAL
4	A	R408 IS 68 WAS 120	20DEC61	B Burke



* INDICATES COMPONENT VALUES MATCHED WITHIN 1% OF EACH OTHER.

FOR PART REQUIREMENTS SEE LIST OF MATERIAL 37000-007

REQD	PART NO.	DESCRIPTION	ITEM
		LIST OF MATERIALS	

8. NUMBERS SURROUNDING ROTOR BLADES INDICATE CONTACT NUMBERS.
7. ARROW ON ROTOR BLADE INDICATES CLOCKWISE ROTATION.
6. ROTOR BLADES OF SWITCH ARE SHOWN IN EXTREME CCW POSITION (.5US).
5. BOXED LETTERS INDICATE SPECIFIC LABELED EYELETS ON CIRCUIT BOARD.
4. BOXED WORDING INDICATES FRONT PANEL NOMENCLATURE.
3. ALL CAPACITOR VALUES LESS THAN ONE ARE IN µF.
2. ALL CAPACITOR VALUES GREATER THAN ONE ARE IN µµF.
1. ALL RESISTOR VALUES ARE IN OHMS ½W, 10%

NOTES: UNLESS OTHERWISE SPECIFIED

REFERENCE DESIGNATION			ASSOCIATED DRAWING	USED ON	NEXT ASSY	FINAL ASSY
FIRST USED	LAST USED	OMITTED	APPLICATION		QTY REQD	
C401 R401	C406 R409		H40000-000	M-102		

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES; TOLERANCES ON: 3 PLACE DEC. ±; 2 PLACE DEC. ±; ANGLES ±; MATERIAL; FINISH; DO NOT SCALE DWG.

DRAWN: GRANADOS 7/16/61
CHECKED: J.S. Feir 18 Jul 61
APPROVED: Mgr 12 Jul 61
APPROVED: D.H. Stonecipher 18 Jul 61
APPROVED:
RELEASED: B.C. Smith 20 Dec 61

TITLE: SCHEMATIC — PULSE WIDTH SWITCH
MODEL 102
SCALE NONE

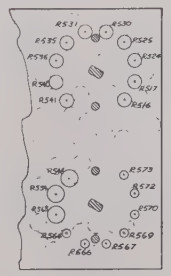
DATAPULSE, INC. INGLEWOOD CALIFORNIA

DWG SIZE D — 40000-003
SHEET OF

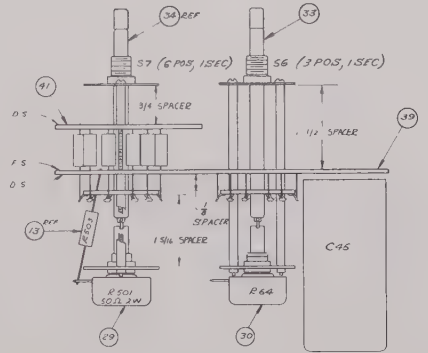
40000-003 A

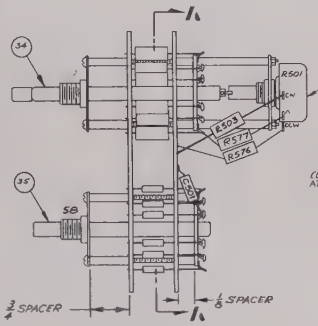
REVISIONS				
ECN	SYM	DESCRIPTION	DATE	APPD
4	A	ADDED R575, R576, R577, R146 ADDED C73, C74 C75, C76 C501	28 DEC 61	B Busick

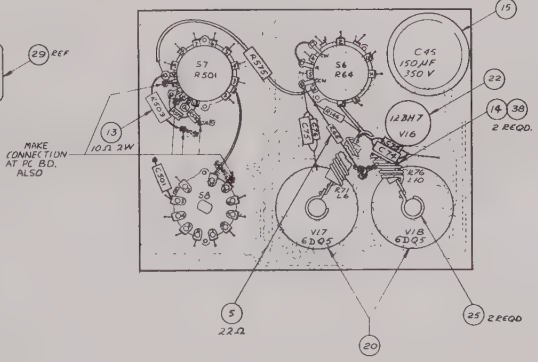
REF DES	ITEM NO	VALUE
E1 6	9	1.1Ω W
E517	9	15Ω 1W
R524	10	5.6Ω 1W
R525	10	
R530	10	
R531	10	
R535	10	
R536	10	
R540	10	
R541	10	5.6Ω 1W
R546	3	36Ω 2W 5%
R550	3	36Ω 2W 5%
R563	3	36Ω 2W 5%
R564	1	36Ω ½W 5%
R566	1	
R567	1	
R569		
R570	1	
R572	1	
R573	1	36Ω ½W 5%
R575	11	2.7Ω 1W
R576	11	2.7Ω 1W
R577	11	2.7Ω 1W
R146	6	390Ω ½W 10%
C73	18	27 MMF 500V
C74	16	4-30 MMF 20KV
C75	16	4-30 MMF 20KV
C76	18	27 MMF 500V
C501	17	100 MMF 500V



SECTION







2. ALL CAPACITOR VALUES ARE IN MMF 500V 5%
1. ALL RESISTOR VALUES ARE ½ W 10%

NOTES: UNLESS OTHERWISE SPECIFIED.

ITEM	PART NO.	DESCRIPTION	MFG

LIST OF MATERIALS

MODEL 108	1		
MODEL 102	1		
NEXT ASSY	USED ON	NEXT ASSY	FINAL ASSY
APPLICATION		QTY REQD	

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES; TOLERANCES ON X PLACE DEC. ±, X PLACE DEC. ±, ANGLES ±; MATERIAL; FINISH; DO NOT SCALE DWG.

DRAWN	H.A. Starkopf	8/29/61
CHECKED	B Busick	30 nov 61
APPROVED	H.A. Starkopf	12/6/61
APPROVED		
APPROVED		
RELEASED	B Busick	12/6/61

TITLE: ASSEMBLY- ATTENUATOR AND OUTPUT AMPLIFIER

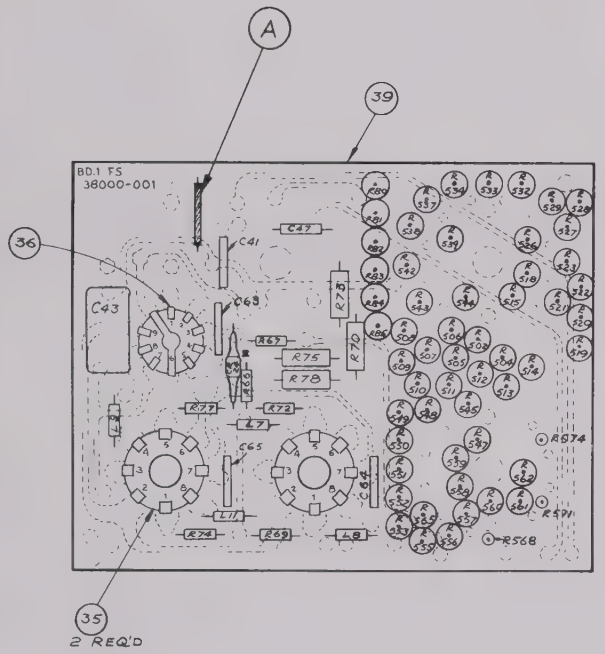
DATAPULSE, INC. INGLEWOOD CAL. OMEGA

DWG NO. 37000-000 | SIZE D | SCALE 1:1 | SHEET 1 OF 1

37000-000 A

REVISIONS				
E.C.N.	SYM	DESCRIPTION	DATE	APPROVAL
4	A	REPLACED R79 10Ω 2W WITH A JUMPER	28 DEC 61	B Busich

REF. DES.	ITEM NO.	VALUE	REF. DES.	ITEM NO.	VALUE
R66	8	4.7K	R555	2	390Ω 2W 5%
R67	7	100K	R556		
R69	6	10Ω	R557		
R70	11	2.7Ω 1W	R558		
R72	6	10Ω	R559		
R73	11	2.7Ω 1W	R560		
R74	6	10Ω	R561		
R75	11	2.7Ω 1W	R562	2	390Ω 2W 5%
R77	6	10Ω	R565	3	47Ω 2W 5%
R78	11	2.7Ω 1W	R568	1	47Ω 5%
			R571	1	47Ω 5%
R80	17	150Ω 2W	R574	1	47Ω 5%
R81		150Ω 2W			
R82					
R83					
R84					
R85	17	150Ω 2W			
R502	21	47Ω 2W			
R504	15	10Ω 2W			
R505	15	10Ω 2W	C41	28	2UUF ± 20%
R506	15	10Ω 2W	C43	27	1UF 400V 10%
R507	19	2.7K 2W	C47	26	220
R508					
R509			C63	28	.01UF ± 20%
R510			C64	28	.01UF ± 20%
R511			C65	28	.01UF ± 20%
R512					
R513					
R514	19	2.7K 2W			
R515	15	10Ω 2W			
R518	15	10Ω 2W			
R519	16	1K 2W	CR 24	29	IN34A
R520	16	1K 2W			
R521	16	1K 2W			
R522	16	1K 2W			
R523	18	1.5K 2W			
R526	23	820Ω 2W			
R527	23	820Ω 2W	L7	32	1UH
R528	23	820Ω 2W	L8	32	1UH
R529	23	820Ω 2W	L9	32	1UH
R532	22	680Ω 2W	L11	32	1UH
R533					
R534					
R537					
R538					
R539					
R542					
R543					
R544	22	680Ω 2W			
R545	4	36Ω 2W 5%			
R547					
R548					
R549					
R550					
R551					
R552					
R553	4	36Ω 2W 5%			



FOR PART REQUIREMENTS REFER TO LM 37000-001

REQD	PART NO.	DESCRIPTION	ITEM

LIST OF MATERIALS

2. ALL CAPACITOR VALUES ARE IN UUF 500V 5%
1. ALL RESISTOR VALUES ARE ½ W 10%

NOTES: UNLESS OTHERWISE SPECIFIED:

37000-000	MODEL 102,104	1	1
NEXT ASSY	USED ON	NEXT ASSY	FINAL ASSY
APPLICATION		QTY REQD	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
3 PLACE DEC. ± | 2 PLACE DEC. ± | ANGLES ±
MATERIAL
FINISH
DO NOT SCALE DWG.

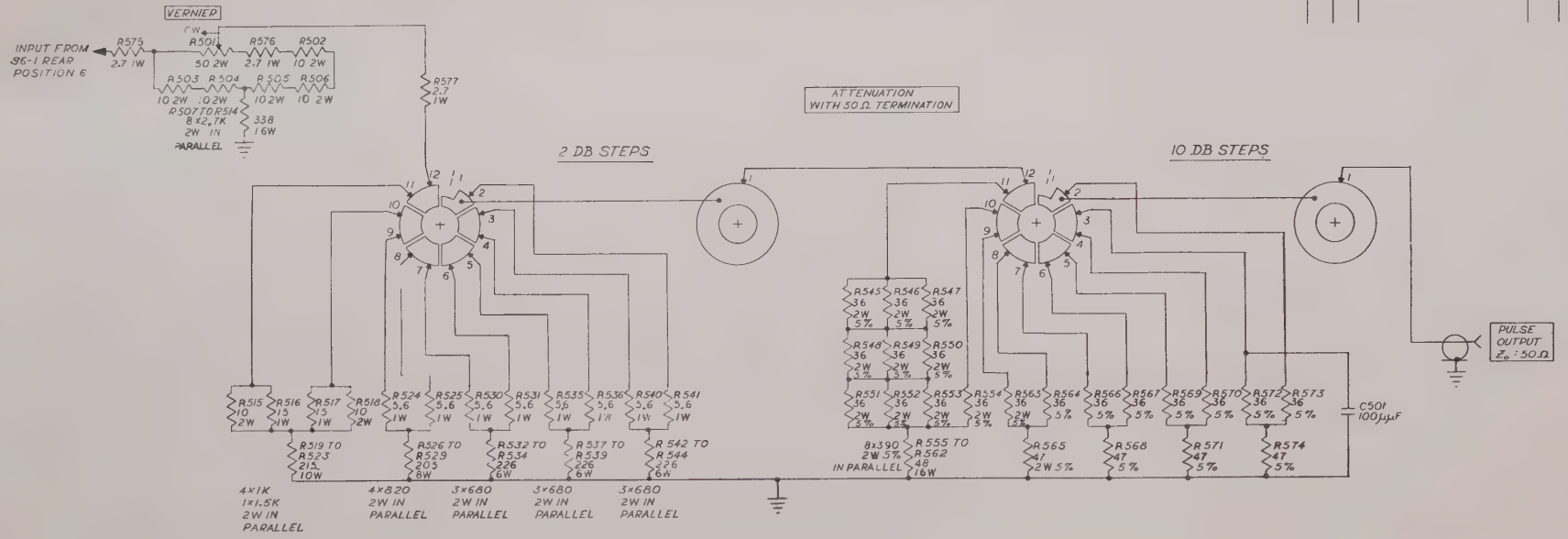
DRAWN	M.A. Stoffregen	8/29/61
CHECKED	B Busick	29 AUG 61
APPROVED	M.H. Stoffregen	9/2/61
APPROVED		
RELEASED	B Busick	20 SEP 61

TITLE
SUB ASSEMBLY - BOARD NO 1
ATTENUATOR AND OUTPUT AMPLIFIER

DATAPULSE
DATAPULSE, INC.
INGLEWOOD, CALIFORNIA

DWG SIZE C | 37000-001
SCALE 1:1
SHEET 1 OF 1

37000-001 | A



REVISIONS				
E.C.N.	DTD	DESCRIPTION	DATE	APPROVED
4	A	R575, 576, 577, (2.7 1W) ADDED C501 (100μμF) ADDED	28 DEC 61	B Bessick

FOR PART REQUIREMENTS SEE LIST OF MATERIAL 37000-000

REQD	PART NO	DESCRIPTION	ITEM
		LIST OF MATERIALS	

2. ROTOR BLADES OF SWITCHES ARE SHOWN IN EXTREME CCW POSITION AS VIEWED FROM CONTROL KNOB
1. ALL RESISTOR VALUES ARE IN OHMS, ½ W, 10%

NOTES: UNLESS OTHERWISE SPECIFIED

C501 R501	C501 R577		H40000-000	M-104 M-102	
FIRST USED	LAST USED	OMITTED	ASSOCIATED DWG	USED ON	NEXT ASSY
REFERENCE DESIGNATION			APPLICATION		QTY REQD

DRAWN	D.H.C.	7/16/61
CHK	B. Bessick	18 Jul 61
APP		12 Jul 61
APP	M.D. Sorensen	6/6/61
RELEASED	B. Bessick	6/6/61

TITLE: SCHEMATIC ATTENUATOR 60DB 10W 10%

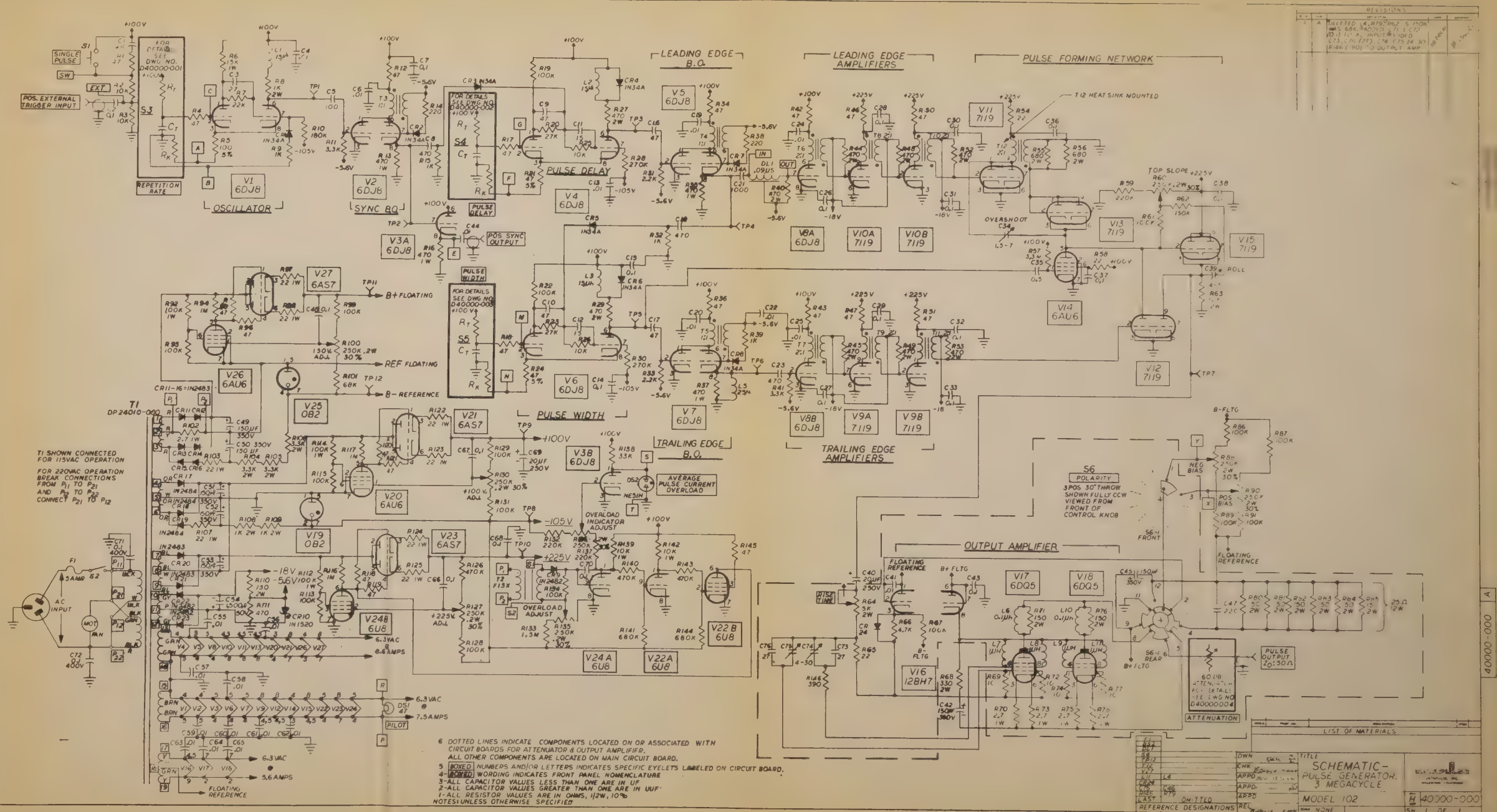
DATAPULSE INC. HOLLYWOOD, CALIFORNIA

SCALE NONE

SIZE D 40000-004

SHEET 1 OF 1

40000-004 A


SINGLE PULSE
SW
EXT
POS. EXTERNAL TRIGGER INPUT
REPETITION RATE
OSCILLATOR
SYNC BQ
PULSE DELAY
POS SYNC OUTPUT
PULSE WIDTH
LEADING EDGE B.Q.
LEADING EDGE AMPLIFIERS
PULSE FORMING NETWORK
TRAILING EDGE B.Q.
TRAILING EDGE AMPLIFIERS
OUTPUT AMPLIFIER
B+ FLOATING
REF FLOATING
B- REFERENCE
AVERAGE PULSE CURRENT OVERLOAD
OVERLOAD INDICATOR ADJUST
OVERLOAD ADJUST
FLOATING REFERENCE
PULSE OUTPUT 50Ω
ATTENUATION
S6 POLARITY
3 POS. 30° THROW SHOWN FULLY CCW VIEWED FROM FRONT OF CONTROL KNOB
T1 SHOWN CONNECTED FOR 115VAC OPERATION
FOR 220VAC OPERATION BREAK CONNECTIONS FROM P21 TO P22 AND P23 TO P24 CONNECT P21 TO P12
AC INPUT
6.3VAC @ 0.6 AMPS
6.3VAC @ 7.5AMPS
6.3VAC
5.6 AMPS
PILOT
6 DOTTED LINES INDICATE COMPONENTS LOCATED ON OR ASSOCIATED WITH CIRCUIT BOARDS FOR ATTENUATOR & OUTPUT AMPLIFIER; ALL OTHER COMPONENTS ARE LOCATED ON MAIN CIRCUIT BOARD.
5 BOXED NUMBERS AND/OR LETTERS INDICATES SPECIFIC EYELETS LABELED ON CIRCUIT BOARD.
4 BOXED WORDING INDICATES FRONT PANEL NOMENCLATURE
3-ALL CAPACITOR VALUES LESS THAN ONE ARE IN UF
2-ALL CAPACITOR VALUES GREATER THAN ONE ARE IN UUF
1-ALL RESISTOR VALUES ARE IN OHMS, 1/2W, 10%
NOTES: UNLESS OTHERWISE SPECIFIED
REVISIONS
LIST OF MATERIALS
SCHEMATIC - PULSE GENERATOR, 3 MEGACYCLE
MODEL 102
40000-000
SH 1 OF 1
REFERENCE DESIGNATIONS
OMITTED

APPENDICES

PULSE INSTRUMENT NOTES

Though pulse generators may be analogous to a DC switch causing a transient change of DC level, it is the case in modern high speed systems and circuitry that due consideration must be given to the characteristics of the pulse waveform both in generation and application. It can be shown by Fourier analysis that any non-linear waveform may be represented by an infinite series of sinewave components which may be operated upon in both amplitude and phase by circuit parameters. The resulting waveform will then be the infinite series of these modified sinewaves. This is to say that while pulse measurements are normally made in the time domain there is an interdependent relationship upon the frequency response characteristics of a system and the pulse response of that system.

A general purpose pulse generator comprises 5 distinct sections, namely; repetition rate generator, pulse delay, pulse width, pulse forming, and output. It may be well at this point to examine these functions in detail.

The Repetition Rate Section is composed of:

(1) The internal oscillator. This oscillator developes the basic repetition rate of the instrument and may be calibrated in either pulse spacing or frequency (pulse spacing= $\frac{1}{\text{frequency}}$). Some of the important considerations are frequency range, drift, stability under line voltage fluctuation, and cycle to cycle jitter. The emphasis placed on certain of these criteria will determine the type of oscillator used. Provision may be made to drive the generator from an external source this providing sync with outside phenomenon.

(2) The second portion of the repetition rate generator is the synchronization section which accepts the output of either the internal oscillator or external drive and provides a trigger to the delay unit in conjunction with a system "0" time reference. (delay is measured with respect to this).

(3) In addition a third function may be provided where by a gating control is used such that the train of pulses may be either interruped or initiated during the duration of an external gate.

Pulse Delay Considerations Are:

(1) Delay range and coverage which must be wide enough to cover a variety of applications.

(2) Resolution or precision is generally of a greater importance than accuracy particularly as "setups" requiring a high degree of accuracy are generally made with an oscilloscope and the resetability gained by high resolution is a particular asset.

(3) High duty cycle capability is an important consideration to insure that desired delay settings are available for a given repetition frequency.

(4) Delay jitter constitutes noise in the time domain and should be kept to a minimum.

(5) In pulse advance operation the main pulse is triggered directly and the output of the delay unit provides a reference sync variable in time which effectively advances the main pulse.

(6) Stability is always a major consideration. The generator should be stable not only under conditions of fluxuating line voltage but under varying duty cycle.

Pulse Width:

Pulse width can be termed delay of trailing edge with respect to leading edge and as such essentially the same technique may be used. "Clipping lines" are sometimes used employing the reflections of an improperly terminated delay line to provide width definition, however, these are usually cumbersome, not continuously variable and usually severely restricted in range. "Clipping lines" are generally only used to advantage on pulse widths of 25 nanoseconds or less. As delay circuitry is generally analogous to width circuitry the same relative advantages and disadvantages apply.

Pulse Forming:

A number of pulse forming techniques are employed including flip-flops, overdriven amplifiers, clipping amplifiers and complex networks to mix leading edge, trailing edge and duration components. The important feature of pulse forming circuitry is control over parameters such as overshoot, top slope, etc.

Output:

Output amplifiers are also varied. However, a few generalizations may be shown.

Output amplifiers are generally driven by positive pulses, acting as cathode followers to provide a positive output and acting as amplifiers (inverters) to provide a negative pulse output.

The output impedance (Z_o) of a cathode follower is approximately $\frac{RK}{GMRK+1}$. The output impedance of an amplifier is approximately $\frac{Rp\ RL.}{Rp+RL}$

Given a typical tube such as a 6DQ5 which has an approximate gm=10,000 and Rp=5,000 ; assume RL=RK=1,000 . Substitution gives US for a cathode follower

$$Z_o = 91 \text{ ohm}$$

for amplifier

$$Z_o = 980 \text{ ohm}$$

Now let the internal load (RK, RL) increase without bound $RK=RL \rightarrow \infty$ substitution gives for a cathode follower

$$Z_o = \frac{1}{gm} = 100 \text{ ohm}$$

for an amplifier

$$Z_o = Rp = 5,000 \text{ ohm}$$

From this we see that a cathode follower has an inherently low source impedance (Z_o) and as such may be used to drive low impedance cables without an attendant loss of voltage. This provides a good voltage generator.

Amplifiers on the other hand with a relatively high Z_o tend to approximate a constant current generator ($Z_o \rightarrow \infty$) and as such are particularly well suited to current generator applications such as core switching etc.

A positive going grid waveform tends to draw grid current resulting in high gm.while a negative going grid is always below the cathode resulting in lower gm. For this reason source impedance is generally lower during leading edge time than during decay time giving rise to the tendency of pulses to have a faster rise than decay.

If an excess of grid current is drawn in the search for fast rise, overshoot will occur. The best form of output is achieved when both positive and negative pulses occur with base line at ground. This can be accomplished by arranging the output configuration such that the power supply ground reference is switched as polarity is selected. If pulses are generated at other DC levels than ground then they must necessarily be condenser coupled out on a general purpose generator. This leads to differentiation of wide pulses and base line shifts with changes in duty cycle.

Two methods of amplitude control are predominate, first is varying output bias or the amplitude of the driving waveform.

These methods cause variations in output source impedance and may cause variations in waveform parameters. However, this method reduces the amount of power required from the output stage and allow higher width duty cycles to be available without exceeding maximum average current limitations.

The second method is a constant impedance attenuator. The characteristics of this method are diametrically opposed to the variable bias method in that extreme waveform fidelity is maintained if the load impedance is matched to the attenuator. On the other hand, as the attenuator simply draws power from the load a constant output power is required from the output stage regardless of ultimate amplitude of the output waveform. In short, variable bias conserves output power at the expense of waveform fidelity while a constant impedance attenuator preserves waveform fidelity at the expense of output power.

Average output current is $I_a = \frac{E_o D}{Z}$ where E_o is the output pulse voltage; Z is the total load including internal load, attenuator if any, and external load; and D is pulse width duty cycle. For this reason the output power limitation of pulse generators are generally specified as 1. a maximum pulse width duty cycle D given E_o and Z or, 2. a maximum I_a with E_o, D, and Z variable.

PULSE INSTRUMENT NOTES

Low impedance cables are used almost exclusively for the interconnection of the pulse outputs to external loads as they provide shielding and proper ground return for fast rise pulses.

However, shielded cables are transmission lines and must be properly terminated lest they give rise to reflection and possiblity of oscillation. Also to be considered are residual parameters of components, such as lead length, inductive component of wire wound resistors and electrolytic condensers, etc. Even the "non inductive" wire wound resistors exhibit appreciable inductance at the higher frequencies present as leading edge components of fast rise pulses.

Available pulse powers of 50 watts are not uncommon, therefore, careful consideration must be given to the power rating of the load when high pulse width duty cycles are used.

Required source impedance (Z_o) for driving a circuit is given by the equation

$$Z_o = \frac{tr}{2.2C}$$

where tr is the rise time required and C is the input capacity of the circuit driven. From this it is readily apparent that the input admittance of an oscilloscope probe precludes observation of high impedance phenomenon without alterations in both amplitude and rise time.

In the area of oscilloscope observation, one must note the effect of the vertical amplifier response of the oscilloscope upon rise time observation.

$$t_{obs} = \sqrt{t_{in}^2 + t_{scope}^2}$$

gives the relationship of observed rise time, scope rise time and actual rise time. This equation may be written

$$t_{in} = \sqrt{t_{obs}^2 - t_{scope}^2}$$

For example, given vertical amplifier response of 15 nanoseconds and a rise time is observed to be 18 nanoseconds, then the actual rise time

$$t_{in} = \sqrt{18^2 - 15^2}$$

or approximately 10 nanoseconds while an observed 16 nanoseconds would be an actual 5 nanoseconds (twice as fast). It is then apparent that for observations of phenomenon in the region of 10 nanoseconds and less, resolution of most oscilloscopes is not sufficient for actual comparison. Two solutions present themselves. First is the use of a traveling wave oscilloscope or if the phenomena is reoccurring, a sampling

technique. The second is a method of displaying the desired signal directly upon the deflection plates of the oscilloscope. Most manufacturers such as Tektronix, Dumont, and Hewlett-Packard have this feature available.

ABBREVIATIONS & DEFINITIONS

Cer	Ceramic
Comp	Composition
EMC	Electrolytic Metal Case
f	Farad
GMV	Guaranteed minimum value
h	Henry
K	Kilohm or 10^3 ohms
M/ceramic	Mica or ceramic
Meg or M	Megohm or 10^6 ohms
μ	Micro or 10^{-6}
$\mu\mu$	Micromicro or 10^{-12}
M	Milli or 10^{-3}
Ω	Ohm
v	Volt
w	Watt
WW	Wire Wound
$\not{z}$	Impedance

For further abbreviations see MIL-STD-12B or MIL-STD-16B.

Symbols follow MIL-STD-15A

ABBREVIATIONS & DEFINITIONS

Duty Cycle in %= $\frac{\text{duration of event}}{\text{duration of period}}$ X100

Delay is defined from the 50% point on the leading edge of the sync pulse (t=0) to the 50% point on the leading edge of the output pulse.

Pulse width is defined from the 50% point on the leading edge to the corresponding point on the trailing edge of a pulse.

Rise time is the time between the 10% and 90% amplitude levels on the leading edge of a pulse.

Overshoot and ringing; overshoot is a damped oscillation on the leading corner of the pulse, expressed as a % of pulse amplitude. If several cycles of oscillation exist it is referred to as ringing.

Top slope is the amount of sag or droop on the top of a pulse measured as a % of pulse amplitude.

Decay time, sometimes referred to as fall time, is the time between the 90% amplitude point and the 10% amplitude point on the trailing edge of a pulse.

Undershoot is a damped oscillation occurring at the completion of decay time.

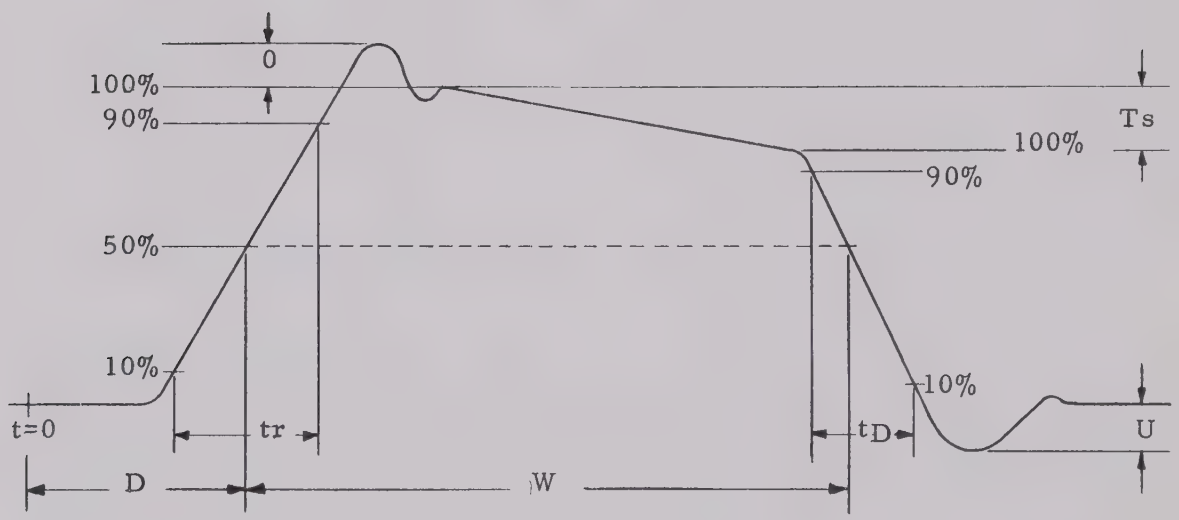
Jitter is defined as a variation in time of any pulse parameter from cycle to cycle.

Accuracy - the "closeness" to a given figure which may be obtained.

Precision or Resolution - that smallest increment of a given figure which may be defined.

"Base line around ground" is defined as $-0.5v \leq$ Base line $\leq +0.5v$.

ABBREVIATIONS & DEFINITIONS



D = Delay
W = Pulse Width
tr = Rise Time
0 = Overshoot
Ts = Top Slope
t_D = Decay time
U = Undershoot

INSTRUMENT CERTIFICATION

MODEL 102 SN#_____

Instrument has been aged for 24 hours and fully calibrated prior to this test. _____

REPETITION RATE

Oscillator Covers 2 CPS to 3MC _____

Accuracy ±10% _____

No holes in Vernier coverage _____

Jitter $\leq$ 0.08% _____

EXTERNAL TRIGGER

20V RMS Drive Required
from 200 CPS to 500 KC _____

+20V Pulse Drive Required
from 0 CPS to 3 MC _____

SINGLE PULSE

Each depression of push button provides
one cycle of output _____

SYNC PULSE

Amplitude $>$20V open circuit
$>$10V into 100 ohm
at 3MC _____

MAIN PULSE DELAY

Delay covers 0.2μs to 10MS _____

Accuracy ± 10% _____

No "Holes" in Vernier Coverage _____

INSTRUMENT CERTIFICATION

Max duty cycle $\geq$ 70% _____

Jitter $\leq$ 0.05% _____

MAIN PULSE DURATION

Duration covers 0.05μs to 10MS _____

Accuracy ± 10% _____

No "Holes" in Vernier Coverage _____

Jitter $\leq$ 0.05% _____

MAIN PULSE OUTPUT

Amplitude $\geq$ 50V delivered into
50 ohm load (Positive and negative) _____

Attenuator Accuracy ± 10% _____

WAVEFORM

Overshoot variable to $\leq$ 4%. _____

Rise time variable to 0.5us _____

Top slope variable to $\leq$ 3% (Less than
1MS duration) _____

Rise time $\leq$ 10 nanoseconds. (Pos. & Neg.) _____

Decay time $\leq$ 10 nanoseconds (Pos. & Neg.) _____

AVERAGE PULSE CURRENT OVERLOAD

Circuit limits average pulse current
at 225ma _____

INSTRUMENT CERTIFICATION

Average pulse current overload lamp lights at 200ma _____

R136 [overload indicator Adj] and R135 [overload adj] sealed with red glyptol. _____

I certify that this instrument meets all of the above specifications and conforms to DATAPULSE Standard 91200-000 for workmanship and appearance.

SIGNED _____
Final Test Inspector

DATE _____

INSTRUMENT CERTIFICATION

Average pulse current overload lamp lights at 200ma _____

R136 [overload indicator Adj] and R135 [overload adj] sealed with red glyptol. _____

I certify that this instrument meets all of the above specifications and conforms to DATAPULSE Standard 91200-000 for workmanship and appearance.

Q. C. ACCEPTANCE	
INSPECTOR	DATE

SIGNED _____
Final Test Inspector

DATE _____

DATAPULSE

APPLICATIONS BULLETIN

No. 102-4

DATAPULSE INCORPORATED, 509 HINDRY AVE., INGLEWOOD 1, CALIF. ORCHARD 1-7713 - OREGON 8-3383

OUTPUT AT GROUND

The positive pulse output of the DATAPULSE Model 102 is specified with baseline nominally around ground, that is, less the +0.5v.

Some applications, such as certain diode tests, require a baseline more near ground. This may be accomplished on the 102 by (1) increasing output bias or (2) using a dc offset.

Both of the above methods have advantages. Use the method best suited to your requirements.

INCREASING OUTPUT BIAS

This method of adjusting baseline dc level may be accomplished by resetting two internal adjustments.

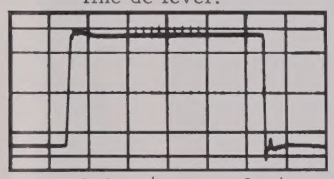
1. With the polarity switch set on POSITIVE, set the 150v supply to 120v by means of R100 (150v Adj.).
2. Set the repetition rate control to EXT. and observe the dc level at the pulse output jack.
3. Adjust R90 (Pos. Bias) for the required baseline dc level.

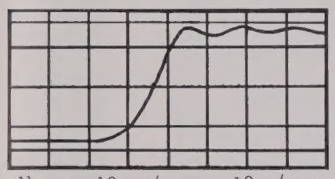
Excellent waveform may be obtained with this method; however, since the output tubes are not being driven as firmly (due to increased bias), rise time is increased to approx. 15 nanoseconds and the output amplitude is reduced by approx. 20%. See Figures 1 and 2.

DC OFFSET VOLTAGE

This method will improve waveform character, but it requires an outside dc source connected as shown in Figure 4. With connections shown in Figure 4 made, place the repetition rate control on EXT., the polarity switch on POSITIVE and observe the dc level at the output jack. Adjust the dc offset voltage until desired baseline dc level is obtained.

Better waveform is obtained than when using the bias shift method, and since the output is driven firmly, negligible increase is noticed in rise time. A slight variation is noticed in amplitude due to loading effects of the offset circuit. The baseline may be placed below ground if desired. The waveform obtained with this method is shown in Figure 3.





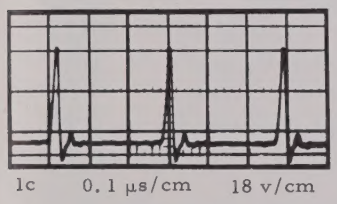
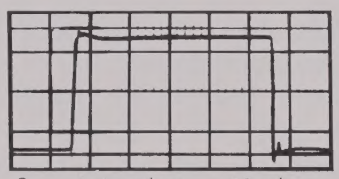
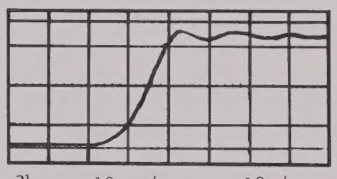


Figure 1. Pos. Pulse with Baseline +50mv Off Ground by Adjusting Output Bias.

(a) 1 μs Wide Pulse at 5 KC
(b) Leading Edge of (1a). Illustrates Rise Time.
(c) Positive Pulse at 3 MC.





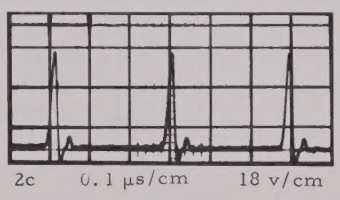
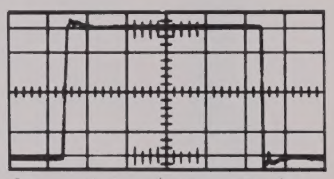
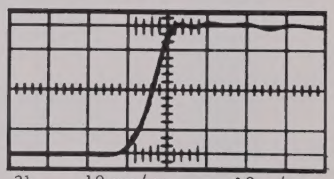


Figure 2. Pos. Pulse with Baseline +10mv Off Ground by Adjusting Output Bias.

(a) 1 μs Wide Pulse at 5 KC
(b) Leading Edge of (2a). Illustrates Rise Time
(c) Positive Pulse at 3 MC





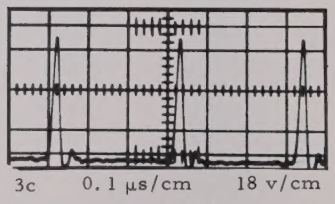


Figure 3. Pos. Pulse with Baseline Less Than 1mv Off Ground by Using DC Offset.

(a) 1 μs Wide Pulse at 5 KC
(b) Leading Edge of (3a). Illustrates Rise Time
(c) Positive Pulse at 3 MC

Photographs were taken from a Tektronix Type 581 Oscilloscope.

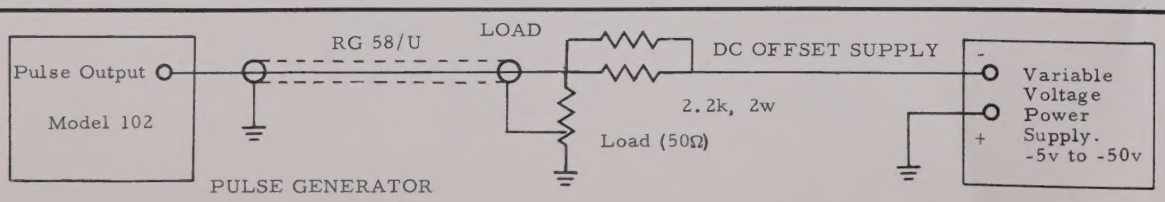


Figure 4. Wiring a DC Offset Supply for Variable Baseline Output of Datapulse Model 102. Baseline may be varied over a range of ±1 volt.

WARRANTY

Datapulse Incorporated warrants each instrument of its manufacture to be free from defects in material and workmanship. Our obligation under this Warranty is limited to servicing or adjusting any instrument returned to our factory for that purpose, and to making good at our factory any part or parts thereof except tubes, transistors, fuses or batteries which shall, within one year after making delivery to the original purchaser, be returned to us with transportation charges prepaid, and which our examination shall disclose to our satisfaction to have been thus defective.

Instruments returned under this Warranty will not be accepted at the Datapulse plant without prior authorization by a Datapulse representative or by the service manager of Datapulse Incorporated.

Datapulse Incorporated reserves the right to make changes in design at any time without incurring any obligation to install same on units previously purchased.

This Warranty is expressly in lieu of all other obligations or liabilities on the part of Datapulse Incorporated and Datapulse Incorporated neither assumes nor authorizes any other person to assume for them any other liability in connection with the sales of Datapulse Incorporated instruments.